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REVIEW
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APPLIED ENTOMOLOGY.

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CORRÊA (R. R.) & DA S. RAMOS (A.). **Do encontro do *A.* (*N.*) *darlingi* Root, 1926, e do *A. oswaldoi* var. *metcalfi* Galvão & Lane, 1937, naturalmente infetados com os parasitas maláricos, na região sul do Estado de São Paulo.** [*A. darlingi* and *A. oswaldoi* var. *metcalfi* naturally infected with malarial Parasites in the southern Part of the State of São Paulo.]—*Folia clin. biol.* **13** no. 6 pp. 183–191, 5 figs., 11 refs. São Paulo, 1941. (With a Summary in English.) [Recd. December 1942.]

Anopheles darlingi, Root, was found infected with malaria parasites in Brazil and Venezuela in 1931 [*R.A.E.*, B **19** 188 ; **20** 9], and other infected examples have since been taken in Brazil. In the course of surveys in 1941 in the southern part of the State of São Paulo, *A. darlingi* was found in dwellings in two localities inhabited by persons harbouring gametocytes of *Plasmodium vivax* and *P. falciparum*. The one example taken in the first locality and 2 of 33 taken in the other contained oöcysts. Larvae of *A. darlingi* were collected among the stems of *Eichhornia azurea* floating at the banks of a river some 100–200 yards from the houses in the second locality.

A. oswaldoi var. *metcalfi*, Galvão & Lane, was not found indoors, but was taken feeding on infected persons posted near the houses in the second locality. Of the 24 females examined, 2 contained oöcysts. *A. strodei*, Root, and *A. albitarsis*, Arrib., were also taken in very small numbers, but none was infected. The larvae of *A. o. metcalfi* occur in water of the most diverse character, but chiefly in pools covered with vegetation.

COUTINHO (J. O.). **O *Anopheles* (*N.*) *oswaldoi metcalfi* Galvão & Lane, 1937 e o *Anopheles* (*N.*) *albitarsis* Arribalzaga, 1878 como transmissores de malaria no Distrito Federal.** [*A. oswaldoi* var. *metcalfi* and *A. albitarsis* as Vectors of Malaria in the Federal District.]—*Brasil-med.* **56** no. 4–5 pp. 52–55, 3 figs., 11 refs. Rio de Janeiro, 1942.

The author briefly discusses the identity of the three varieties of *Anopheles oswaldoi*, Peryassú [*cf. R.A.E.*, B **27** 13], and states that 651 and 157 of 852 Anophelines taken in 1941 in dwellings in the Federal District of Rio de Janeiro were var. *metcalfi*, Galvão & Lane, and *A. albitarsis*, Arrib., respectively. Of 147 caught in coach houses, 137 were var. *metcalfi* and 5 *A. albitarsis*. Var. *metcalfi* was also taken on a horse in the open and fed on man and horse indiscriminately. Oöcysts, including both *Plasmodium vivax* and *P. falciparum*,

were found in 9 of 307 females of var. *metcalfi* (one of which also contained sporozoites in the salivary glands) and in 1 of 150 of *A. albitarsis* taken in houses in November and December, and it is concluded from these figures that var. *metcalfi* was the more important vector of malaria. Larvae of var. *metcalfi* were collected in quiet water protected by aquatic plants.

REES (D. M.). **Supplementary List of Mosquito Records from Utah (Diptera, Culicidae).**—*Pan-Pacif. Ent.* **18** no. 2 pp. 77–82, 3 refs. San Francisco, Calif., 1942.

The only Anopheline included in this supplementary annotated list of mosquitos taken in Utah since 1934 [*cf. R.A.E.*, B **23** 82] is *Anopheles pseudopunctipennis*, Theo.

DE BUCK (A.). **Kreuzungsversuche mit** *Stegomyia fasciata* **Fabricius und** *S. albopicta* **Skuse.** [Crossing Experiments with *Aëdes aegypti*, L., and *A. albopictus*, Skuse.]—*Z. angew. Ent.* **29** pt. 2 pp. 309–312, 6 refs. Berlin, 1942.

Attempts to cross laboratory strains of *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.) and *A.* (*S.*) *albopictus*, Skuse, failed to confirm the results obtained by Toumanoff [*R.A.E.*, B **26** 98; **27** 47], though females of each species were shown to have spermatozoa in the spermatheca. No embryonic development occurred in eggs laid by females of *A. albopictus*, and the only larva that hatched from eggs laid by those of *A. aegypti* died in a few hours.

MITAMURA (T.), YAMADA (S.), HAZATO (H.), MORI (K.), HOSOI (T.), KITAOKA (M.), WATANABE (S.), OKUBO (K.) & TENJIN (S.). **Ueber den Infektionsmodus der epidemischen Enzephalitis. Experimentelle Untersuchungen über ihre Ansteckung durch Mücken.** [On the Mode of Infection with Epidemic Encephalitis. Experimental Investigations on Transmission by Mosquitos.]—*Trans. Soc. path. jap.* **27** pp. 573–580, 9 refs. Tokyo, 1937. [Recd. December 1942.]

As the authors had concluded from epidemiological and other evidence that Japanese epidemic (summer) encephalitis must be transmitted by mosquitos, they carried out experiments designed to confirm this conclusion. *Aëdes togoi*, Theo., and *Culex pipiens* var. *pallens*, Coq., were used in the first experiment and the latter only in all the others. Injection into mice of emulsions of mosquitos that had been fed on highly virulent emulsions of the brains of mice showed that the virus first underwent a more or less distinct decline and then began to increase, so that in the course of 10 days in the case of *C. p. pallens* and 15–20 days in that of *A. togoi*, the virulence of the mosquito body was about the same as it had been immediately after the infective meal.

In transmission experiments, infected females of *C. p. pallens*, divided into four groups according to the method by which they had acquired the virus, were allowed to feed on mice. The mosquitos of the first three groups obtained the virus by feeding on emulsions of mouse brain of different degrees of virulence, while those of the fourth group obtained it by biting infected mice. Mice were infected by mosquitos of each group, but much the highest percentage (67·6) was infected by the first group, which had the most favourable conditions, and the concentration of virus in the saliva of a single infective mosquito of this group was found to be probably higher than the highest concentration in the infected mouse brain. The rate of increase of the virus in the mosquitos and their infectivity were both higher when they were kept at temperatures above 27°C. [80·6°F.] than when they were kept at lower temperatures. Out of 10 monkeys (*Macacus rhesus*) bitten by infected mosquitos, only one, which had

been bitten by 73, developed typical encephalitis. Some of the mice and monkeys acquired immunity as a result of inapparent infection. It is possible that this occurs in man also, as antibodies are found in the serum of normal persons in various localities in Japan. Their incidence and power appear to be correlated with the rates of infection of the neighbourhoods under consideration.

To determine whether mosquitos harbour encephalitis virus in nature, suspensions were prepared from 3,000 adults and 3,000 larvae of *Culex pipiens* var. *pallens* and filtered through a Berkefeld V filter. The filtrate showed itself in both cases quite inactive against mice. Investigations on this subject should be continued [see next abstract]. There are two possible ways in which the virus may be acquired by mosquitos in nature, by biting and through ovarian infection. In experiments on ovarian infection, encephalitis was induced in mice by the inoculation of eggs laid by mosquitos that had fed on infected mouse brain. It is emphasised that all epidemiological and experimental evidence indicates that Japanese summer encephalitis is not transmitted by droplet infection.

In small-scale experiments on the transmission of a laboratory strain of St. Louis encephalitis received from the United States, individuals of *C. p. pallens* fed on 10 per cent. virus-bearing mouse-brain emulsion, kept at an average temperature of 25°C. [77°F.] and placed on mice at various times, transmitted the disease to six out of 62 mice, and the brains of six others were found to contain the virus.

MITAMURA (T.), KITAOKA (M.), WATANABE (S.), HOSOI (T.), TENJIN (S.), SEKI (O.), NAGAHATA (K.), JO (K.) & SHIMIZU (M.). **Weitere Untersuchungen über die Uebertragung der japanischen epidemischen Enzephalitis durch Mücken.** [Further Investigations on the Transmission of Japanese Epidemic Encephalitis by Mosquitos.]—*Trans. Soc. path. jap.* **29** pp. 92–105, 1 fig., 9 refs. Tokyo, 1939. [Recd. December 1942.]

In this paper, further evidence is given of the transmission of Japanese epidemic (summer) encephalitis by mosquitos [see preceding abstract]. From the beginning of March 1938 until the end of March 1939, mosquitos were collected daily in a building in the town of Okayama, with the exception of three days in winter. The mosquito population curve showed two peaks, a small one in spring, caused by the appearance of adults of the overwintered generation, some of which had had a blood meal when captured, and a large one in summer, caused by the emergence of increasing numbers of fresh adults. The number of mosquitos in the summer peak was greatest at the end of July. Some three weeks after this peak, a small epidemic of encephalitis broke out in the prefecture of Okayama and lasted about 40 days. The chief species of mosquitos taken were *Culex pipiens* var. *pallens*, Coq., *C. tritaeniorhynchus*, Giles, and *Anopheles hyrcanus* var. *sinensis*, Wied. Females of each species of *Culex* taken between 25th July and 24th August 1938 infected mice on which they fed. No tests with the Anopheline were made during this period, and tests with these and other mosquitos taken earlier or in September were negative; mosquitos taken later than September were not tested. In further investigations on ovarian infection, the virus was again shown to be present in eggs deposited by artificially infected individuals of *C. p. pallens*, and it was also demonstrated in the first-instar larvae hatching from such eggs. Furthermore, 12 mice became infected out of 511 bitten by females of this species that had developed in the laboratory from larvae and pupae taken in nature and that had therefore had no opportunity of acquiring the virus in the adult stage.

When dogs brought in February from Hokkaido, which is free from epidemic encephalitis, to Tokyo, an epidemic area, were tested for antibodies in their serum and for latent infection, the results from February to May were negative, while all tests on 18th June were more or less positive for antibodies. The

potency of the antibodies reached its maximum in August. As regards the demonstration of virus in the blood, positive results were obtained in July, August and November. Out of four people who had recently come to Tokyo from Hokkaido, only one did not acquire antibodies during the summer, and one of the others had virus in the blood and saliva in August.

van Hoof (L.), Henrard (C.) & Peel (E.). **Irrégularités de la transmission du** *Trypanosoma gambiense* **par** *G. palpalis.—Ann Soc. belge Méd. trop.* **20** pp. 227–243. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **46** pt. 12 p. 313. Hamburg, 1942.)

Guineapigs, though highly susceptible to infection by *Trypanosoma gambiense*, sometimes fail to become infected when bitten by infected examples of *Glossina palpalis*, R.-D. The authors' experiments show that failure may be due to various causes. In some instances, there was a loss of the salivary gland infection, which the flies usually retain throughout life. Various strains of the trypanosome also differ in transmissibility to guineapigs. Even when transmission has been accomplished, the lower infective capacity of a strain may result in a longer period of incubation. A strain obtained from a patient who had been infected 10 years previously developed in *G. palpalis*, but could not be transmitted by it to guineapigs. Guineapigs can also prove temporarily resistant to infection, for an animal that has resisted infection sometimes acquires it later, even when the same strain and the same individual fly are used.

Pavlov (P.). **Epizoozia di paralisi da zecche nelle capre in Bulgaria.** [An Epizootic of Tick Paralysis in Goats in Bulgaria.]—*Riv. Parassit.* **4** p. 227. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **46** pt. 12 p. 318. Hamburg, 1942.)

In the Wratza distict of Bulgaria, tick paralysis in goats is caused by *Haemaphysalis cinnabarina punctata*, C. & F., *H. inermis*, Bir., and a species of *Hyalomma* here called *H. aegyptium*, L. [but *cf. R.A.E.*, B **24** 196]. Mortality in untreated animals may amount to 25–50 per cent.

Eichler (W.). **Die wirtschaftliche Bedeutung der Mallophagen (Haarlinge und Federlinge).** [The economic Importance of Mallophaga.]—*Anz. Schädlingsk.* **16** p. 32. 1940. (Abstr. in *Dtsch. tropenmed. Z.* **46** pt. 12 pp. 319–320. Hamburg, 1942.)

The economic importance of Mallophaga has been generally underestimated, as they have been thought to feed only on the débris from skin and feathers. Some species, however, feed regularly on blood, such as *Trimenopon jenningsi*, Kellogg & Paine, which infests guineapigs [*cf. R.A.E.*, B **27** 26] and transmits typhus among them in Bolivia [**24** 313]. *Trichodectes canis*, DeG., is an intermediate host of a dog tapeworm, probably *Dipylidium sexcoronatum* [*cf.* **8** 115], while *Bovicola ovis*, L., is a pest of sheep in Australia and *B.* (*Werneckiella*) *equi*, L., causes a dermatitis in horses that resembles mange.

Zumpt (F.). *Ornithodorus moubata* **Murray und andere Rückfallfieberzecken.** [*Ornithodoros moubata* and other Ticks transmitting Relapsing Fever.]—*Dtsch. tropenmed. Z.* **46** pt. 12 pp. 321–328, 10 figs., 9 refs. Hamburg, 1942.

Notes are given on the appearance and biology of *Ornithodoros moubata*, Murr., and other ticks of the same genus that are vectors of relapsing fever in various parts of the world, together with a table showing the ticks concerned, the species of *Spirochaeta* that are transmitted by them, and the regions in which they occur. Measures of avoiding attack and controlling the ticks are briefly discussed.

Robinson (G. G.). **The Penetration of Pyrethrum through the Cuticle of the Tick,** *Ornithodorus moubata* **Murray (Argasidae).**—*Parasitology* **34** no. 1 pp. 113–121, 3 graphs, 12 refs. London, 1942.

The larvae of *Ornithodoros moubata*, Murr., become motionless an hour or two after hatching and remain so, without feeding, for the rest of the stage, which lasts about 4 days. In the course of tests with contact insecticides, it was noticed that a pyrethrum spray stimulated the larvae to move their legs. Experiments are described in which groups of 5–10 larvae were immersed in oil containing various amounts of pyrethrum extract to determine the time that elapsed before stimulation was effected. The following is substantially the author's summary of the results. There is a logarithmic relation between concentration and speed of stimulation, except with concentrated solutions (stronger than 0·015 per cent. by weight of pyrethrin I) in which the increase in speed of response is less than would be expected from this relation. It is probably the pyrethrin II that is responsible for stimulation [*cf. R.A.E.*, B **27** 24], but as no figures were available for the concentration of this principle, the figures for pyrethrin I are given to serve as an indication of the successive dilutions used. As larvae grow older, they respond more slowly ; this is probably due to an increase in the thickness of the cuticle in natural growth. Mineral oils induced a much swifter penetration of the pyrethrum than any of the vegetable oils used.

Koutz (F. R.). **Ticks and their Importance in small Animal Practice.**—*Vet. Med.* **36** no. 9 pp. 470–473, 11 refs. Chicago, Ill., 1941. [Recd. December 1942.]

Certain species of ticks that occur in tropical and sub-tropical regions have been transported to and become established in many parts of the United States as a result of the practice of sending hunting dogs to the south in winter and of increased travelling in the winter by tourists with their dogs. *Rhipicephalus sanguineus*, Latr., was formerly limited to a small area of Texas but has now spread to many States, and caused great annoyance in houses in Ohio, particularly in 1940–41, and in one of the wards of the State University veterinary hospital in 1939–40. It is a three-host tick. The duration of the egg stage and the minimum durations of the feeding and moulting periods are given, but the larvae, nymphs and adults can survive many months without food, and the periods of engorgement and moulting may vary considerably. On leaving the host, the ticks crawl upwards along a wall until they reach a crack or crevice in which to oviposit or moult, and crawl down the walls when in search of a fresh host.

R. sanguineus is the vector of canine piroplasmosis caused by *Piroplasma* (*Babesia*) *canis* in the United States and of canine anaemia caused by *Hepatozoon canis* in other continents. It does not normally attack man, but cases of attachment of the nymph to man have been reported. An experiment has been described in which numerous unsuccessful attempts were made to induce the larvae to attach themselves to man. To eradicate the ticks from the veterinary hospital, cages and floors were cleaned with hot water and creolin solution and steamed, only paper was used for bedding, a mixture of derris and pyrethrum powder in equal parts was sprinkled in cracks and crevices, under the paper in the cages and behind the window and door casings, all the dogs in the ward were examined, and all but one were dusted daily with a derris powder containing at least 4 per cent. rotenone. The untreated dog was kept in the ward for seven months to attract any ticks present. Many were removed from it during the first few weeks, but none was found on it after four months. No ticks have since been found in the ward. Houses were freed of ticks by dusting cracks and crevices in walls and skirting boards with derris, dusting the dog with it

every day and burning any ticks found. The derris caused the ticks to release their hold on the host in addition to killing them, so that no abscess resulted at the site of attachment. Alcohol also caused them to release their hold but did not kill them.

Another tick that is becoming widespread is *Dermacentor variabilis*, Say. It is usually found in woods, fields or underbrush and is also a three-host tick, the larval and nymphal stages being usually passed on rodents and the adult stage on dogs, man, cattle and other animals. The egg stage lasts about a month, and the larvae and nymphs engorge in 3–10 days. The total life-cycle may be completed in a few months or last several years. *D. variabilis* transmits Rocky Mountain spotted fever and tularaemia to man, and both it and *R. sanguineus* are reported to cause paralysis in dogs. *Ixodes ricinus scapularis*, Say, which is a common parasite of dogs, is a three-host tick with a wide variety of hosts. The entire life-cycle may take from 6–7 months to 3 years. Feeding periods are short. Distinguishing features of *R. sanguineus* and the genera *Dermacentor* and *Ixodes* are given.

In the winter of 1940–41, ticks found on 25 horses brought to northern Ohio from the west proved to be *D. albipictus*, Pack., which had not previously been recorded in Ohio.

ZUMPT (F.). *Rhipicephalus appendiculatus* **Neum. und verwandte Arten. VI. Vorstudie zu einer Revision der Gattung** *Rhipicephalus* **Koch.** [*R. appendiculatus* and related Species. Sixth preliminary Study for a Revision of the Genus *Rhipicephalus*.]—*Z. Parasitenk.* **12** pt. 5 pp. 538–551, 12 figs., 30 refs. Berlin, 1942.

In this sixth paper of a series, of which the first has been noticed [*R.A.E.*, B **29** 49], are included descriptions and a discussion of the classification of *Rhipicephalus appendiculatus*, Neum. (of which the author considers *R. neavei*, Warb. [**3** 91] to be a synonym) and three related species.

R. appendiculatus is of great importance as the vector of the causal organism [*Theileria parva*] of African Coast fever of cattle [*cf.* **28** 76] and is a three-host tick. In the laboratory, larvae and nymphs fed readily on guineapigs and rabbits. The larvae dropped off after 3–7 days and moulted after about a fortnight at 30°C. [86°F.]. The nymphs engorged in 4–9 days and also moulted after about a fortnight. The adults fed readily on sheep, and the females dropped off after 7–9 days. At 30°C., oviposition began 3–5 days later, and the eggs hatched in about 3 weeks. Guineapigs also proved to be satisfactory hosts for the adults, and the females dropped off after 8–14 days.

In the field, the adults are chiefly found on cattle, especially on the ears. Sheep and goats are also readily infested. Recorded wild hosts are the wart-hog, antelopes, Cape buffalo, elephant and lion.

HERTER (K.). **Untersuchungen über den Temperatursinn von Warmblüter-Parasiten.** [Investigations on Thermotropism in Parasites of warm-blooded Animals.]—*Z. Parasitenk.* **12** pt. 5 pp. 552–591, 6 figs., 2 pp. refs. Berlin, 1942.

A detailed account is given of experiments on the thermotropic reactions of ectoparasitic Arthropods in the temperature gradient apparatus devised by the author [*R.A.E.*, A **22** 728], and the following is based on his summary of the results. In non-parasitic animals, thermotropism serves mainly to avoid harmful temperatures and to ensure optimum vital conditions. In ecto-parasites of warm-blooded animals, it also serves as a guide towards the host, stimulates feeding and limits the duration of infestation. In most of the parasites that remain on their host only when feeding, such as the tick, *Argas reflexus*, F., and bugs (species of *Cimex*, *Triatoma*, etc.), the preferred temperature

for starving individuals is about the same as the surface temperature of the host. The parasites therefore seek bodies having the temperature of the host and are thus guided to the latter. The temperature on the skin of the host incites them to feed. When the parasites are engorged, they prefer a much lower temperature, probably the one favourable for digestion, and this certainly contributes to their departure from the host. Different parasitic stages of the same species have the same preferred temperature. Temporary parasites such as adult fleas (*Ctenocephalides canis*, Curt.) which remain on their hosts for longer periods than are required for feeding, have the same preferred temperature (approximately that of the host) whether starving or engorged, but the larvae prefer a lower temperature, corresponding to the cooler environment in which they develop. In permanent parasites, such as lice (*Pediculus humanus*, L., and *P. h. capitis*, DeG.), the preferred temperature for nymphs and adults corresponds to the temperature of the skin of the host. Hunger can cause the preferred temperature to be somewhat reduced, but this is of no ecological importance and is possibly due to desiccation. *Phthirus pubis*, L., had no preferred temperature.

HASE (A.). **Ueber Erfolgskontrollen und ihre biologischen Grundlagen bei Entlausungsmassnahmen.** [On Efficiency Checks of the Destruction of Lice and their biological Bases.]—*Z. Parasitenk.* **12** pt. 5 pp. 592–606, refs. Berlin, 1942.

Success in treatments against lice [*Pediculus humanus*, L.] in clothing or other materials requires their application by experienced personnel, and should be assessed whenever possible by observation of test samples of lice and their eggs. Lice vary considerably in their resistance to treatment, and resistant forms must be included in the samples. If they can be obtained by selection of laboratory bred material, a sample should consist of 10–15 adults of both sexes, 20–25 nymphs in the second and third instars and about 50 eggs, but if the lice have to be collected from clothing, the numbers should be increased to 30–40, 50–100 and 100, respectively, to ensure that resistant forms are included. At least five bags, each containing a test sample, should be distributed at spots that are least accessible to treatment.

Resistance in adults and nymphs depends partly on their state of nutrition and is greatest when digestion is nearly complete; this condition occurs at clothing temperature about 4–5 hours after a blood meal. Old adults are less resistant than young ones. The nymphs are most resistant in the third instar, and less so just before or after a moult. Dark brown lice are more resistant than white ones, but the transitional colour forms are more resistant than either. Newly laid eggs and eggs about to hatch are less resistant than eggs 3–4 days old.

Lice that have been subjected to treatment may be dead, moribund, numb or unaffected. Eggs killed by heat are shrivelled, have a horny brown appearance, and do not crack or emit fluid when squeezed. All eggs that are plump and yellowish or whitish (as eggs treated chemically usually are) should be incubated at 30–32°C. [86–89·6°F.] for at least 10 days. to ascertain whether they are viable. In border-line cases the eggs give rise to nymphs that die in the process of hatching ; a treatment should not be considered successful if this occurs in more than 10 per cent. of the samples. As the eggs are usually more resistant than the later stages, they provide a useful standard.

The condition of nymphs and adults should be judged by a combination of characters. Those shown by normal lice are immediate resumption of the usual position when turned on their backs, movement towards and away from light, nymphal moults after blood meals, pairing, oviposition, feeding, crumb-like excreta, peristalsis and heart-beat. The occurrence of feeding is especially important and should be verified by placing the lice on the skin. Lice can be

considered dead if the antennae and feet do not move when touched, there is no peristalsis or heart-beat, pressure on the abdomen displaces the contents of the intestine permanently, and the body is inflated, coloured red-brown or brown, and desiccated. If the lice are merely numb, peristalsis is sometimes absent, but the intestinal contents return to the normal position if displaced by pressure. Numbness due to cold passes comparatively quickly, but that caused by respiratory poisons sometimes persists for several hours. Individuals that revive should be kept under observation, for they are sometimes moribund. Lice that are moribund lie on their backs or if in the normal position, move their feet spasmodically without advancing appreciably, and show no orientation to light ; the penis is extruded and cannot be retracted ; the intestinal contents are packed forwards and can be displaced permanently by pressure ; there is incapacity to feed even if the intestine is almost empty ; slight intestinal movement occurs in hungry individuals ; the excreta appear in the form of a cord (about 1 cm. long) or of large lumps at the rear of engorged individuals ; and there are signs of shrivelling and of brown or red coloration of the body. Lice that appear moribund should be kept under observation, and the survival periods noted. If the lice are moribund in all the samples, it indicates that the treatment is effective but has not acted sufficiently long.

HALLER (H. L.), LA FORGE (F. B.) & SULLIVAN (W. N.). **Effect of Sesamin and related Compounds on the insecticidal Action of Pyrethrum on Houseflies.**—*J. econ. Ent.* **35** no. 2 pp. 247–248, 6 refs. Menasha, Wis., 1942.

As sesame oil has been found to increase the effectiveness of pyrethrum solution against house-flies [*Musca domestica*, L.] much more than any other vegetable or fish oil tested, attempts were made to isolate the compound responsible for this synergistic effect. When sesame oil was separated into four fractions by molecular distillation, and each fraction was added to pyrethrum extract in refined kerosene and tested against *M. domestica*, two of the fractions had practically no influence on the effectiveness of pyrethrum, but the other two increased it more than did the original sesame oil, and sesamin, a colourless crystalline compound with the formula $C_{20}H_{18}O_6$, was subsequently isolated from these two fractions combined. When sesamin was added to pyrethrum extract in refined kerosene containing 10 per cent. acetone, the percentage mortality in 24 hours was raised to 85, as compared with 20 for the pyrethrum alone, but it was also raised to 89 by the addition of the non-crystalline fraction left after removal of most of the sesamin. The acetone in the kerosene was necessary to dissolve the sesamin ; the concentrations of pyrethrins and the two sesame oil fractions in this test were 1 and 2·5 mg. per cc., respectively. Similar tests with the available compounds related to sesamin showed that pinoresinol, pinoresinol dimethyl ether and diacetyl pinoresinol had no appreciable action, but isosesamin and asarinin, which have the same molecular formula as sesamin but differ in the arrangement of the atoms, were equally effective. It appears, therefore, that the nature of the substituents on the benzene ring is the determining factor in the synergistic action of this class of compounds, and that their spatial configuration is of little or no importance, whereas it has been shown that optical activity plays an important part in the insecticidal action of nicotine, rotenone, deguelin and toxicarol.

DEWEY (J. E.). **The relative Effectiveness of Dust Mixtures against the German Cockroach.**—*J. econ. Ent.* **35** no. 2 pp. 256–261, 5 refs. Menasha, Wis., 1942.

Laboratory studies on the relative effectiveness of mixtures of dusts against *Blattella germanica*, L., were carried out with 41 different materials or mixtures in an attempt to find one that would be more effective, less dangerous and less expensive than the commonly used mixtures of sodium fluoride and pyrethrum.

The method is described, and involved confining the cockroaches for 10 minutes in a chamber having a deposit of 0·81 mg. dust per sq. cm. on the floor. The average time required for this deposit of sodium fluoride to kill adult females (19·1 hours) was used as the standard of comparison. The results indicate that first-instar nymphs are least resistant to sodium fluoride, while the order of increasing resistance of other forms was second- and third-instar nymphs, fourth- and fifth-instar nymphs, adult males, adult females, sixth- and seventh-instar male nymphs and sixth- and seventh-instar female nymphs. Aluminium oxide, bauxite and Anderson's Clay (aluminium silicate), which act as antidotes for sodium fluoride in mammals, were found to accelerate its toxic action to *B. germanica*, even when they formed as much as 50 per cent. of the powder. Aluminium sulphate, the best antidote for sodium fluoride, retarded its toxic action, but in a mixture of sodium fluoride, pyrethrum, aluminium sulphate, pyrophyllite and bauxite (20 : 10 : 5 : 30 : 35), the aluminium sulphate added to the powder as granules did not reduce its effectiveness. The average survival times for mixtures of sodium fluoride and pyrethrum (50 : 50 and 75 : 25) were 3·5 and 5 hours. A powder containing 1·4 parts pyrethrum extract (2 per cent. pyrethrins), 4 parts sodium fluoride, 6 parts lubricating oil and 89 parts pyrophyllite, mixed in petrol and dried, gave a knockdown of all cockroaches treated and a survival time of 7·7 hours. Pyrethrum, sodium fluoride and pyrophyllite (12·5 : 25 : 62·5), and sodium fluoride and 2, 4-dinitro-6-cylohexylphenol (50 : 50), which latter caused leg paralysis, were at least as effective as sodium fluoride and pyrethrum. Sodium fluoride and borax in equal parts caused quicker kill (6·7 hours), and sodium fluoride and borax at 10 : 90 slightly quicker kill (15·7) than sodium fluoride alone. Sulphite lye (Goulac) showed good activating qualities for sodium fluoride, and sodium acid fluoride was somewhat more effective than sodium fluoride, but both have unsatisfactory physical properties. Of the powders that showed average survival times of 20–50 hours, 2, 4-dinitro-6-cyclohexylphenol, lycopodium powder and dinitrobenzene when used with pyrophyllite in equal parts by weight were found to be quite toxic and might be used should sodium fluoride become unavailable. Pure derris dust was as effective as pure pyrethrum dust. Pyrethrum and pyrophyllite (25 : 75) was more effective than pyrethrum powder alone. Sodium fluoride, pyrethrum and pyrophyllite (8 : 3 : 89) gave nearly complete kill in less than 50 hours, which is considered remarkable in view of the small proportion of active ingredients. Freshly hydrated lime greatly accelerated the toxicity of sodium fluoride (particularly at 67 : 33 and 50 : 50), but it is of doubtful value as an activator as it carbonates on exposure to air. Males were more susceptible than females to all the dusts tested.

De Bach (P.). **A simple Method of obtaining standardized Houseflies.**—*J. econ. Ent.* **35** no. 2 pp. 282–283, 3 refs. Menasha, Wis., 1942.

In order to obtain clean puparia of *Musca domestica*, L., of known age for laboratory work, the full-fed larvae were removed from the breeding medium [*cf. R.A.E.*, B **20** 261] by straining through wire window gauze (16 mesh) by means of a strong stream of water. The larvae remained uninjured in the strainer. The medium was not allowed to get dry on top, as if it did it would not pass through the sieve. If some of the medium did not strain easily, the sieve was put in the mouth of a battery jar, and a strong light placed above. This caused the negatively phototropic maggots to wriggle through the gauze and drop into the jar [*cf.* **27** 57]. A cloth was kept in the bottom of the jar to dry the larvae, as they can easily climb out of a glass container when wet. They usually began to pupate within 24–48 hours of removal from the medium, and puparia of a similar age group could then be obtained by exposing the larvae and puparia to light, when the larvae would move away. This can be repeated at intervals of as little as one hour if desired.

Brumpt (E.) & Desportes (C.). **Grande longévité du virus de la fièvre pourprée des Montagnes Rocheuses et de celui du typhus de São-Paulo chez** *Ornithodorus turicata.—Ann. Parasit. hum. comp.* **18** no. 4–6 pp. 145–153, 4 figs., 2 refs. Paris, 1941. [Recd. December 1942.]

In a continuation of previous experiments [*R.A.E.*, B **25** 121], infected examples of *Ornithodoros turicata*, Dugès, again failed to transmit Rocky Mountain spotted fever or the São Paulo form of Brazilian exanthematic typhus to guineapigs by biting. Positive results were, however, obtained in injection experiments including two each made with suspensions of four individuals infected over 4½ years previously with Rocky Mountain spotted fever and two made with similar numbers infected nearly 5 years previously with Brazilian typhus, though in the latter case the reaction was mild. The result of a single experiment on the inoculation of the coxal fluid of ticks infected with Rocky Mountain spotted fever was positive. The epidemiological importance of *O. turicata* is discussed in the light of these findings. In view of the fact that the adults are too hard to be easily crushed (though the young nymphs are not) and that guineapigs did not develop Rocky Mountain spotted fever as a result of ingesting infected ticks, it is concluded that it is slight.

Galliard (H.). **Recherches sur le mécanisme de la transmission des filaires par les culicidés.**—*Ann. Parasit. hum. comp.* **18** no. 4–6 pp. 209–214, 1 pl., 17 refs. Paris, 1941. [Recd. December 1942.]

The author reports having observed filarial larvae emerging from the labella of mosquitos [*cf. R.A.E.* B **20** 81]. Microphotographs are reproduced showing a larva of *Filaria* (*Wuchereria*) *bancrofti* emerging from a labellum of *Culex fatigans*, Wied., and one of *F.* (*Dirofilaria*) *immitis*, emerging from that of *Aëdes albopictus*, Skuse. Certain peculiarities of behaviour that may arise are described, and the effect on experimental results of severing the head or proboscis of the mosquito and of administering chloroform are discussed. A stimulus of some kind, probably of a mechanical nature, is necessary for the larva to burst the tip of the labellum. Experiments indicated that contact with human or animal skin alone is not sufficient. The principal stimulus in nature is undoubtedly the flexion of the proboscis in biting [*cf.* **30** 17]. In an experiment, however, infective larvae were eliminated equally rapidly from mosquitos fed on sugar and water [*cf.* **16** 67]. It was never found possible to prevent mosquitos kept at the optimum temperature for development of the filariae from shedding their larvae. The larvae reached the proboscis in 9–10 days at 30–35°C. [86–95°F.] and in 17 days at 26–31°C. [78·8–87·8°F.]. None was ever found more than seven days later. If the temperature is not maintained at a favourable level, the mature larvae remain indefinitely in the mosquito. The number of larvae of *F. immitis* usually found in the proboscis of females of *A. albopictus* or *A. aegypti*, L., which are small species, is four or five. On one occasion, 13 larvae were found in the proboscis of *A. aegypti*. It seems possible that in certain circumstances the labium may burst under the pressure of a large number of larvae. Infested mosquitos usually lived as long as controls.

Séguy (E.). **Étude biologique et systématique des sarcophagines myiasigènes du genre** *Wohlfahrtia.—Ann. Parasit. hum. comp.* **18** no. 4–6 pp. 220–232, 2 figs., 2½ pp. refs. Paris, 1941. [Recd. December 1942.]

The habits of species of *Wohlfahrtia*, the larvae of which show remarkable parasitic tendencies and are responsible for severe myiasis in man and animals, are summarised, chiefly from the literature. In central and southern Europe and northern Africa, these flies emerge from the beginning of June until the beginning of September. Between these times they frequent open spaces. They

follow man and animals, but do not seek to enter houses. They are attracted by carrion and decomposing matter, and also by animals with wounds having a more or less pronounced smell. They feed on a variety of substances, including sweet liquids, moisture exuding from wounds of plants or animals, decomposing matter and pollen. Pairing takes place soon after emergence, and larviposition occurs between 10 a.m. and 4 p.m., preferably on hot and stormy days. One female may produce 120–170 larvae at one time or in little groups of 10 or more. The larvae, which are briefly described, can withstand a fairly sudden fall of temperature and can develop on a large variety of animals. Man is attacked particularly in the region of the nose, mouth and ears. On animals, the larvae occur not only in the natural openings of the body and in previously existing wounds, but also in hollows where sebaceous matter accumulates and ferments rapidly, and their presence sets up ulceration, which enables them to penetrate. Small animals often die very soon after they are attacked, and the larvae complete their development on the carcass. The full-fed larvae fall to the ground and pupate just below the surface of the soil. The pupal period lasts 7–12 days.

It is stated that examination of a long series of *W. nuba*, Wied., showed that there are two well defined forms which are confused in Salem's description in a paper already noticed [*R.A.E.*, B **27** 120]. In his key, Salem places *W. nuba* among the species that have a definite femoral comb, whereas in his description of the species he states that no comb is present. Close examination revealed several distinguishing characters among specimens without the comb, and also showed the presence of a certain number of intermediate forms. Descriptions are given of the two extreme forms based on specimens from Tunisia, and the form from which the comb is absent is designated *W. volucris*, sp. n. A key is given to the species of the Old World.

RISTORCELLI (A.) & DAO VAN TY. **Mission E. Brumpt et L.-Ch. Brumpt en Colombie. III. Phlébotomes d'une région de Colombie où la verruga du Pérou est devenue endémique depuis trois ou quatre ans.**—*Ann. Parasit. hum. comp.* **18** no. 1–3 pp. 72–74. Paris, 1941. **III. Phlébotomes d'une région de Colombie où la verruga du Pérou est devenue endémique depuis deux ou trois ans (seconde note).**—*T. c.* no. 4–6 pp. 251–269, 2 pls., 9 figs., 11 refs. [Recd. December 1942.]

These papers deal with 21 specimens of *Phlebotomus* taken in Nariño, Colombia, in 1939. They comprise one female of *P. longipalpis*, Lutz & Neiva, and seven females and two males of *P. evansi*, Nuñez Tovar, from an unspecified locality and one female of *P. osornoi*, sp. n., three females of *P. colombianus*, sp. n., and seven females of *P. monticolus*, Costa Lima, var. *incarum*, n., taken on a horse in the valley of Capuli, at an altitude of about 5,200 ft., in a region where bartonellosis was epidemic [see next abstract]. The new species and variety are briefly characterised in the first paper, and all are described in detail in the second.

BRUMPT (E.) & BRUMPT (L. C.). **Mission E. Brumpt et L.-Ch. Brumpt en Colombie et au Venezuela. VI. Étude épidémiologique concernant l'apparition de la verruga du Pérou en Colombie.**—*Ann. Parasit. hum. comp.* **19** no. 1–3 pp. 1–50, 5 pls., 4 figs., 4 pp. refs. Paris, 1942.

The investigations that showed that the severe epidemic that has occurred in recent years in Nariño, Colombia [*R.A.E.*, B **30** 49] is caused by *Bartonella bacilliformis* are reviewed. The symptoms of the disease were the same as in Peru, though its severity varied with district and individual resistance. In Peru, it is confined to the gorges [**17** 190] as the surrounding area is too arid for sandflies (*Phlebotomus*), but the humidity of the whole of Nariño is sufficiently high, and the disease actually occurs there in two extensive foci on the

plateaux with a maximum altitude of 5,900 ft., separated by an infection-free zone consisting of uneven plateau with an average altitude of 8,200 ft. Acute cases occurred all the year round. The inhabitants of the infected zones make Panama hats, which involves work in places with a very humid atmosphere, even in the dry season, and the work is continued until nightfall. This results in exposure to the bites of sandflies, which feed after sunset. Persons living in dwellings surrounded by fruit trees, which increase humidity and darkness, are attacked more frequently than others. The cottages are dark, with mud floors and walls, and have many cracks that may harbour insects. The inhabitants usually sleep on mats of esparto grass. Domestic animals are rare, with the exception of guineapigs. Sandflies are abundant in the infected area, and five species, two of them new, were found to be represented among 21 individuals examined [see preceding abstract]. None of the species occurring in infested zones in Peru is known to be present in Colombia. A list is given of the American species, with a reference to the paper in which each was described and to their distribution.

It appears to be well established that bartonellosis did not exist before 1936 in the Colombian localities where cases were then first found. It assumed an epidemic form immediately, attacking people of all ages, and no large movement of population had taken place before it appeared. It is considered certain that it was introduced from Peru, but probably not by the agency of sandflies, owing to their fragility. Numerous experiments on the susceptibility of various animals showed that dogs alone can be reservoirs of infection, and they only for a very short time, but persons recovering from acute or inapparent bartonellosis can remain carriers for many months. It is concluded that man is the only important, if not the sole, reservoir, and that the disease was introduced into Colombia by soldiers returning to Nariño after the conclusion of the war between Colombia and Peru in 1934–35.

The literature on the relation to the disease of sandflies, which are certainly its normal vectors, is reviewed, and reference is made to its experimental transmission by a tick [**16** 17]. As it is said sometimes to break out in areas remote from human habitations and there does not appear to be an animal reservoir, it is considered possible that the infected sandflies may be able to transmit the infection to their progeny. The theory that latex-bearing plants can act as a reservoir [**23** 231] is considered to be open to grave doubt [*cf.* **24** 83]. It has not yet been proved that *Phlebotomus* can feed with impunity on the latex. As no specific remedy for bartonellosis is known, the organism cannot be sterilised in the human host. All that can be done is to place infected persons where they cannot be attacked by *Phlebotomus*. The control of sandflies in the regions visited seems practically impossible, but mechanical protection of new-born babies in endemic zones is considered essential. Subjects for further research are suggested, particularly the biology of *Phlebotomus*.

DESPORTES (C.). **Nouvelles recherches sur la morphologie et sur l'évolution d'*Icosiella neglecta* (Diesing 1851), filaire commune de la grenouille verte.**—*Ann. Parasit. hum. comp.* **18** no. 1–3 pp. 46–66, 6 figs., 27 refs. Paris, 1941. [Recd. December 1942.] *Forcipomyia velox* **Winn. et** *Sycorax silacea* **Curtis, vecteurs d'*Icosiella neglecta* (Diesing) filaire commune de la grenouille verte.**—*Op. cit.* **19** no. 1–3 pp. 53–68, 5 figs., 3 refs. 1942.

Observations carried out at Richelieu (Indre-et-Loire) on the development of *Icosiella neglecta*, the common filaria of green frogs (*Rana esculenta*), and reported in the first paper, led the author to believe that the normal vector is *Lasiohelea* (*Forcipomyia*) *velox*, Winn., a Ceratopogonid that feeds for preference on *R. esculenta* [*R.A.E.*, B **28** 133]. Microfilariae ingested by these midges began to develop towards the sausage form, but their life-history could

not be followed up as the midges did not live for more than about five days in captivity. Of females taken in nature, 5·3 per cent. were harbouring 1–4 infective larvae, one of which attempted to penetrate the skin of a young frog when placed on the tail. There appears to be a certain correlation between the distribution of *I. neglecta* and that of *L. velox.*

In the second paper, an account is given of further observations made possible in 1941 by the development of a satisfactory method of keeping *L. velox* alive in the laboratory. The following is taken mainly from the author's summary of them. The microfilariae of *I. neglecta* showed no periodicity in the peripheral blood of *R. esculenta* and no concentration at the point of the bite of the vector [*cf.* **28** 123–4, etc.]. The larvae developed in the body of *L. velox* in 22 days in August and 26 or more in September and October. They were induced to leave the midges by placing the latter on a drop of frog serum or normal saline. A means of entry into the skin of the vertebrate host, such as a bite, is necessary. Larvae placed on the interdigital skin of living frogs in a drop of normal saline penetrated it only when it had been perforated by a fine needle, in which case they found the wound rapidly and passed into the host in 5–7 minutes. In most of the females of *L. velox* the development of eggs was parallel with that of the larvae of *Icosiella,* and it is considered possible that, as in the case of other filaria vectors, the female transmits infection at the feed following oviposition. *Aëdes aegypti,* L., *Anopheles maculipennis* var. *atroparvus,* van Thiel, and *Culex pipiens,* L., failed to feed on the frogs experimentally. *C. apicalis,* Adams, and *C. hortensis,* Fic., which engorged on them in nature, did not support the development of the filarial larvae. On the other hand, *I. neglecta* developed in *Sycorax silacea,* Curt., which also fed on the frogs, and it is thought that this Psychodid is possibly another vector.

BRUMPT (E.) & DAO VAN TY. **Distribution des biotypes d'*Anopheles maculipennis* en France.**—*Ann. Parasit. hum. comp.* **19** no. 1–3 pp. 69–73. Paris, 1942.

As France is one of the countries in which the question of the spontaneous regression of malaria has been much studied, data are given on the distribution in France and Corsica of the various races of *Anopheles maculipennis,* Mg. This is a matter of practical importance in view of the fact that some of them, such as *A. m. sacharovi,* Favr (*elutus,* Edw.) and *A. m. labranchiae,* Flni., are attracted to man, while others, such as *A. m. messeae,* Flni., *A. m. typicus* and *A. m. melanoon,* Hackett, prefer animals, at least in France, and *A. m. atroparvus* van Thiel, the habits of which differ according to locality, attacks both man and animals, but the latter more readily. The two theories that for the last 100 years Anophelines have lost their habit of biting man and have become more or less strictly zoophilous, and that with changes in the character of breeding places, zoophilous races have taken the place of those attacking man, are mentioned, and the difficulty of sustaining one or the other in the absence of knowledge on the races of *A. maculipennis* that existed in the formerly malarious areas a century ago is pointed out. A table is given showing the forms collected by the authors in seven localities of France in 1940–42. It was found that in Normandy, as in England, Holland and Siberia, *A. m. messeae* does not overwinter in animal sheds and appears in them and in dwellings only in March and April. Another table is a synopsis of all collections made in various localities in France and Corsica by different workers between 1933 and 1942. It shows that the extremely dangerous races, such as *A. m. sacharovi* and *A. m. labranchiae,* exist only in Corsica. In France, *A. m. atroparvus* and *A. m. messeae* are found almost everywhere. The former was certainly responsible for the transmission of the malaria that formerly occurred, while the latter always played a very minor part.

Brumpt (E.). **Notes parasitologiques concernant l'aménagement agricole de la Crau.**—*Ann. Parasit. hum. comp.* **19** no. 1–3 pp. 74–84, 14 refs. Paris, 1942.

The results are given of entomological investigations carried out in Crau and Camargue (Bouches-du-Rhône) by the author and E. Roubaud with a view to the agricultural development of Crau. The mosquitos taken in houses were nearly always females of *Anopheles maculipennis*, Mg., sheltering there after having bitten man, or more often animals, as this species is little attracted to man in this district. It has already been shown to be represented in Camargue by four varieties [*R.A.E.*, B **25** 170 ; **26** 122], *viz.*, *messeae*, Flni., *melanoon*, Hackett, and *atroparvus*, van Thiel, and *cambournaci*, Roub. & Treill., which they consider distinct [*cf.* **28** 119, 120 ; **29** 41, etc.]. Three of these, *messeae*, *atroparvus* and *cambournaci*, exist in Crau, and *A. hyrcanus*, Pall., which attacks man aggressively at sunset, occurs there and also in parts of Camargue [**9** 49]. *A. m. labranchiae*, Flni., and *A. m. sacharovi*, Favr (*elutus*, Edw.) are not found, in spite of an abundance of brackish water, and it is suggested that they may once have been present and that the dying out of malaria in the district may be attributable to their disappearance. The principal vector of malaria in Portugal and Spain is *A. m. atroparvus* ; *A. m. cambournaci* also carries the infection in Portugal. These varieties could cause small epidemics if infective workers are employed in Crau.

Considerable annoyance is caused by species of *Aëdes*, which attack both man and domestic animals ; the most troublesome are thought to be *A. caspius*, Pall., and *A. detritus*, Hal. In March 1942, second- and fourth-instar larvae of the latter were found in ditches by a road bordering salt marshes in water containing 22·4 parts salt per 1,000. The use of *Gambusia* against both *Anopheles* and *Aëdes* is recommended. These fish can resist a salinity of 52 parts salt per 1,000 and reproduce in water having up to 20–25 parts. They multiplied in Camargue and Crau in spite of the presence of predacious fish.

In a section on the adaptation of dairy cattle to local conditions, it is stated that they can easily withstand the climate if well fed. They are attacked by various blood-sucking Diptera, of which only Tabanids are of importance. The best method of protecting them from these flies is to keep them in sheds at certain hours. Dangerous ticks may be brought to Crau and Camargue from Algeria on sheep and oxen. The only species that occur there at present are *Rhipicephalus sanguineus*, Latr., on dogs, and possibly *Ixodes ricinus*, L., which transmits *Piroplasma* (*Babesiella*) *bovis* to cattle and perhaps also, in Chalosse (Landes) and Camargue, *P. bigeminum*. J. Pascal found that 50 young bulls from Hautes-Alpes were infected with the latter in 1937, and 10 of them died. As cattle that have had piroplasmosis become immune, it is recommended that young breeding stock should be introduced from a region where they are likely to have acquired immunity from *P. bovis* through bites of *I. ricinus* received soon after birth.

Watson (Sir M.). **Some Emergency anti-malarial Measures.**—8 pp., 8 pls., 2 figs. London, Ross Inst. industr. adv. Comm., 1942.

As war conditions may make it impossible to obtain oil for use against Anopheline larvae, the effectiveness of flushing as an alternative method of control is discussed. The value of this method was first demonstrated in the control of *Anopheles maculatus*, Theo., in mountain streams in the Cameron Highlands, Malaya [*R.A.E.*, B **25** 30, etc.], where simple forms of tippers and sluices were used. The method was next used in Penang, where J. S. De Villiers invented an automatic siphon-system, which is described in an appendix. It has a main siphon, which is made of an inverted oil drum standing on three concrete blocks above the dam, with a large pipe leading downwards from near the top of the

inside and then horizontally under the dam. Since the water compresses the air in the top of the drum as it rises, a small subsidiary siphon, similar to one already noticed [**29** 169], is fitted inside to suck the air out. In 1937, nearly 200 streams were being flushed along 15 miles of the hill that rises in the centre of the island, and the area, which had formerly been highly malarious, had been practically freed of the disease. Flushing is used throughout the Malay Peninsular even in almost flat land drains, and has the favour of the peasants. An adaptation of the De Villiers siphon was introduced into Ceylon [**27** 207; **29** 6, 7], but was not so successful as was expected as there was not enough water during droughts to fill the dam, and at such times *A. culicifacies*, Giles, breeds in pools. On the western side of southern India, where the malaria season is the pre-monsoon period, sluicing is often accomplished by means of an earth dam with one or more oil drums, the ends of which have been removed, placed to form openings in the dam for releasing the flush. The upper end of the drum is closed by a sheet of wood until the dam is full. These dams are washed away by the monsoon rains and re-erected each year at small cost. Earth dams with wooden sluices and concrete dams are also used in southern India. All are effective, provided that the sluices are water-tight and the flood does not exceed the normal fall of water in wet weather, as otherwise erosion will be caused. Brief notes are given on the placing of dams. Many dams are being erected in northern India, some of the sluices being designed to deliver four times as much water as those used in Ceylon [**27** 207]. A hand-operated sluice gate is incorporated as well as a series of automatic siphons to allow débris and silt that collect at the dam to be scoured out during heavy rains.

When sluicing fails for want of water, breeding of malaria-carrying Anophelines in pools may often be prevented by allowing vegetation to rot in the water, though this may encourage harmless species of *Anopheles* and Culicines. Fascine drains [**30** 122, etc.] are used with success in Africa and Malaya.

SCHMID (F.). **Ueber die Biologie der Dasselfliege.** [On the Biology of Warble Flies.]—*Dtsch. tierärztl. Wschr.* **49** no. 26 pp. 313–316, 7 figs. Hanover, 1941. [Recd. November 1942.]

GÖTZE (R.). **Die Bekämpfung der Dasselfliege.** [Warble Fly Control.]—*T. c.* pp. 316–318, 3 figs., 14 refs.

In the first of these papers, the author discusses from the literature the life-history of *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., which cause great losses to the cattle industry in Germany by affecting the general health and milk-production of the animals and depreciating the quality of the hides. It was previously supposed that after entering the body, the larvae of both species migrated to the back by way of the oesophagus and the spine, but observations have shown that larvae of *H. lineatum* are the commoner in the oesophagus and never occur in the spine. It is now considered that *H. bovis* migrates to the spinal canal by way of the nervous system and from there along the muscles to the back. Larvae of *H. lineatum* migrate over the thoracic cavity or through the intercostal muscles to the oesophagus, where they remain for a time, and then return to the skin by way of the intercostal muscles and migrate beneath it to the back. Infestation by *H. bovis* sometimes leads to paralytic disorders, and that by *H. lineatum* to swellings that hinder swallowing.

The author of the second paper reviews the development in Germany of measures against *Hypoderma* larvae in cattle. In experiments with derris extracts containing rotenone, other extractives or both, he found that the most effective contained rotenone and other extractives in the ratio of 1 : 2. Several proprietary extracts containing 8 per cent. rotenone and 16 per cent. other extractives, but differing in the solvent used, have been marketed. Two thorough applications of a wash containing 2–4 fl. oz. in 5 pints water kill 95–100 per cent. of the larvae under the skin. No treatment is known that will affect the larvae migrating through the body.

Schoop (—). **Ueber die Fuchsräude.** [On Fox Mange.]—*Dtsch. tierärztl. Wschr.* **49** no. 40 pp. 485–486, 1 fig. Hanover, 1941. [Recd. November 1942.]

Schmidt (H. W.). **Sarkoptes-Räude bei Fuchs, Hund und Mensch.** [Sarcoptic Mange in Fox, Dog and Man.]—*T. c.* pp. 487–488.

Mites of the genus *Sarcoptes*, of which the species or variety has not been determined, are stated in the first paper to be responsible for a great increase of mange among wild red foxes in Germany. Silver and blue foxes on fox farms have also been infested, and the mange is transmitted to dogs. For control, all wild foxes should be destroyed in affected districts, and dogs and red foxes should be kept away from fox farms. Ointments are unsatisfactory for treatment, since they are difficult to apply. Dipping is not completely effective, and infested foxes immersed in a 2 per cent. derris dip died of poisoning, even though washed with water afterwards. Fumigation with sulphur dioxide for 30–45 minutes is the most effective method. All objects with which the animals come into contact should be treated with a cresol disinfectant at a concentration of 2–3 per cent., but since this does not destroy the eggs, the operation should be repeated after a fortnight, when these have hatched. The pens should be left vacant for 30 days after treatment.

In the second paper various instances of mange caused by these mites in foxes in German forests are recorded.

Dowling (G. B.) & Thomas (E. W. P.). **Cheese Itch: Contact Dermatitis due to Mite-infested Cheese Dust.**—*Brit. med. J.* no. 4270 p. 543. London, 1942.

Attention is drawn to a form of dermatitis observed in two places in England and affecting the face, neck and wrists of persons handling cheeses or crates of cheeses the surface of which was dusty and infested by *Tyrophagus putrescentiae* (*Tyroglyphus longior*) var. *castellanii*, Hirst. The dermatitis was of an acute diffuse erythematous type, but subsided quickly, though in one case scaling of the eyelids persisted for over a fortnight. Except for a few small urticarial lesions on the forearms of one patient, the eruption in no case suggested a parasitic cause, but was characteristic of dermatitis due to an irritant; as all those who were exposed to the cheese dust seem to have been affected, it would appear that the mites must generate an irritant of considerable potency.

Papers noticed by Title only.

Ristorcelli (A.) & Dao Van Ty. **Mission E. Brumpt et L.-Ch. Brumpt en Colombie et au Venezuela. Morphologie de la femelle de** *Phlebotomus panamensis* **Shannon 1926** [from Venezuela].—*Ann. Parasit. hum. comp.* **18** no. 1–3 pp. 67–71, 1 pl., 1 fig., 9 refs. Paris, 1941. [Recd. December 1942.]

Tulloch (G. S.) & Goldman (M.). **The Malpighian Tubules of** *Aëdes aegypti* **L. (Diptera, Culicidae).**—*Bull. Brooklyn ent. Soc.* **37** no. 2 pp. 52–56, 6 figs., 1 ref. Lancaster, Pa., 1942.

Watson (J. R.). *Sarcophaga bullata* **Parker as a Cause of Intestinal Myiasis** [in Florida].—*Florida Ent.* **25** no. 1 pp. 5–6. Gainesville, Fla., 1942.

Griffiths jr. (J. T.) & Tauber (O. E.). **Fecundity, Longevity, and Parthenogenesis of the American Roach,** *Periplaneta americana* **L.**—*Physiol. Zoöl.* **15** no. 2 pp. 196–209, 11 refs. Chicago, Ill., 1942.

Radford (C. D.). **The larval Trombiculinae (Acarina, Trombidiidae)** [including a list of the species, with hosts and localities and figures, where possible, of the dorsal shields] **with Descriptions of twelve new Species.**—*Parasitology* **34** no. 1 pp. 55–81, 106 figs., 49 refs. London, 1942.

Coutinho (J. O.) & Pereira Barretto (M.). **Dados bionômicos sôbre o** *Phlebotomus fischeri* **Pinto, 1926 (Diptera, Psychodidae).** [Data on the Bionomics of *P. fischeri*.]—*Rev. brasil. Biol.* **1** no. 4 pp. 423–429, 18 refs. Rio de Janeiro, 1941. [Recd. December 1942.]

The authors point out that records in the literature of *Phlebotomus fischeri*, Pinto, before the separation from it of *P. pessoai*, Coutinho & Barretto [*R.A.E.*, B **30** 128], which also occurs in São Paulo, must be regarded as doubtful, and revision of material showed that that of Galvão & Coutinho [**29** 11] undoubtedly refers to *P. pessoai*. A list is given of 13 localities in the State in which *P. fischeri* was taken in 1939–41; only two of them are in the region of high endemicity of the leishmaniasis of the skin and mucous membranes caused by *Leishmania brasiliensis*. The sandfly fauna in these two localities, as in others of the region, was composed almost exclusively of *P. pessoai*, *P. whitmani*, Antunes & Coutinho, and *P. migonei*, França, whereas *P. fischeri* often predominated in areas where the disease had a low endemicity or was sporadic or unknown. It occurred in small woods in mainly agricultural districts and not in the forest zones.

Of 3,031 sandflies, representing 17 species, collected in and near São Paulo city, 2,382 were *P. fischeri*. It was present in considerable numbers throughout the year, but was most abundant during the rainy season from October to March, and was taken in dwellings and animal quarters and, in the woods, on man and dog and in light-traps. It fed readily on man and was often the only sandfly found in dwellings. It was most active after sunset, preferring to withdraw to dark, damp shelters by day. In breeding experiments, development from oviposition to adult emergence usually lasted 50–60 days, but was completed in one case in 46 days. Larval mortality was high in all experiments. *P. fischeri* has been experimentally infected with *L. brasiliensis* by Pessôa & Coutinho (1941), and the authors consider that it may be responsible for the sporadic cases of leishmaniasis that occur in the city of São Paulo.

Griffitts (S. D.). **Ants as probable Agents in the Spread of** *Shigella* **Infections.**—*Science* **96** no. 2490 pp. 271–272. Lancaster, Pa., 1942.

During laboratory experiments in Porto Rico on native food as a culture medium for dysentery bacilli (Flexner strains of *Shigella*), it was found that ants (*Solenopsis geminata*, F.) could carry the bacteria on their feet for at least 24 hours after feeding on, or walking over, infected material.

Toomey (J. A.), Takacs (W. S.) & Tischer (L. A.). **Poliomyelitis Virus from Flies.**—*Proc. Soc. exp. Biol. Med.* **48** no. 3 pp. 637–639, 8 refs. New York, N.Y., 1941. [Recd. November 1942.]

In view of the failure to recover the virus of poliomyelitis (infantile paralysis) from small numbers of houseflies in 20 experiments at Cleveland, Ohio, and the positive results obtained with batches of flies by other workers [*cf. R.A.E.*, B **29** 195; **30** 93, 115], large numbers of flies were caught where they were likely to be infected by placing fly traps near the mouth of a brook that drained the section of the city where the epidemic first appeared in 1941 and emptied raw sewage into Lake Erie. The flies obtained were mostly large blowflies with a few small houseflies. A suspension prepared from 2,000 of them caused the disease when injected into two monkeys. A second isolation of the virus was made from flies collected in an outhouse.

Blattner (R. J.) & Heys (F. M.). **Experimental Transmission of Saint Louis Encephalitis to White Swiss Mice by** *Dermacentor variabilis*.—*Proc. Soc. exp. Biol. Med.* **48** no. 3 pp. 707–710, 12 refs. New York, N.Y., 1941. [Recd. November 1942.]

In view of the transmission of the virus of encephalitis by ticks of the genus *Ixodes* in the Russian Union [*cf. R.A.E.*, B **28** 62; **29** 42, etc.] and the

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experimental transmission of that of equine encephalomyelitis by *Dermacentor andersoni*, Stiles, in the United States [*cf.* **29** 190], experiments were carried out in which 30–40 larvae of *D. variabilis*, Say, from a laboratory colony were placed with each of 4 mice into which the virus of St. Louis encephalitis had been injected. Attachment occurred immediately, chiefly on the ears and snout. After 2 days, one or two young mice were introduced and nestled against the infested adults. The latter died within 4 days, and the larvae, which had fed on them, left them ; some attached themselves to the young mice, several of which subsequently became infected and were shown to harbour the virus. Its presence in the larval ticks was also demonstrated by injecting suspensions of them into mice. Normal adult mice upon which infected, full-grown ticks had fed, developed considerable resistance to intracerebral inoculation of virus.

Stage (H. H.). **Dog Fly Control in northwest Florida.**—*Proc. ent. Soc. Wash.* **44** no. 4 p. 74. Washington, D.C., 1942.

The best means of controlling *Stomoxys calcitrans*, L., which has been breeding in very large numbers in windrows of fermenting aquatic vegetation on the north-western shores of Florida [*R.A.E.*, B **30** 60] and causing considerable losses of cattle, was found to be the application of creosote oil diluted in a light diesel fuel oil to the breeding places along the shoreline by means of a power sprayer [**30** 196]. The treatment was made from barges, each equipped with a power sprayer and lines of hose, operating in the shallow adjacent water. The equivalent of 700 miles of shoreline was treated in 1941, at the rate of about 270 U.S. gals. per mile.

Lever (R. J. A. W.). **The Bed Bug in Melanesia.**—*Agric. J. Fiji* **13** no. 1 p. 26, 4 refs. Suva, 1942.

Cimex hemiptera, F., is common in Fiji and was also common there in 1911. The Fijian name for it (louse from Tanna) suggests that it may have been introduced by Melanesians who came to Fiji from the New Hebrides some 70 years ago. Buxton, in a work already noticed [*R.A.E.*, B **15** 197], suggested that it was a recent introduction in the latter, but the author considers this doubtful as it has been well established for years in the Solomon Islands to the north, whence labourers also came to Fiji in the past.

McKenzie (B. M.). **Population Studies of the domestic Mosquitoes of Marysville, California during the Autumn Season, 1941.**—*Wasmann Collector* **5** no. 1 pp. 9–16, 5 refs. San Francisco, Calif., 1942.

Records are given of the collection of nine species of mosquitos on two staircases outside buildings at Marysville, California, on 35 days between 9th September 1941 and 7th January 1942. Weather conditions during the period are summarised. Except for a single female of *Anopheles punctipennis*, Say, the only Anopheline taken was *A. maculipennis freeborni*, Aitken, which was first observed on 20th September after a very strong west wind had been blowing for some hours. Males of this species were taken occasionally between 21st September and 19th November. After that date the number of females found decreased, and they were infrequent by the end of December, though in January many were seen to rise from disturbed earth and plants. The first frost was on 22nd November, when the minimum temperature was 31°F., and there were morning frosts on the first six days of January. A key is given to the adults of 14 species and one variety of mosquitos common in the area.

Symposium on Encephalitis.—*Proc. 12th Conf. Calif. Mosq. Contr. Ass.* pp. 2–55, 6 graphs, 38 refs. Berkeley, Calif., 1942.

In the first of the papers included in this symposium, which is by B. F. Howitt and is entitled " Relationship of the St. Louis and the Western Equine Viruses

of Encephalitis to Man and Animals in California" (pp. 3–22, 6 graphs, 19 refs.), it is stated that western equine encephalomyelitis has been endemic in California for some years [*R.A.E.*, B **24** 121] and sporadic cases of encephalitis occurred in man until 1937, when there was a marked increase in incidence. Cases first occur each year in April or May and are most numerous in July, August or September. The viruses of both western equine encephalomyelitis and St. Louis encephalitis have been shown to be involved in human cases. They have a similar distribution, and wherever they occurred mosquitos were present at some time during the spring or summer.

In "Newer Developments in Knowledge of Insect Hosts and Vectors of Western Equine and St. Louis Encephalitis" (pp. 23–36, 19 refs.) by W. C. Reeves, the literature on insect transmission of eastern and western equine encephalomyelitis is briefly reviewed, and two experiments are reported in which pigeons produced high titres of antibodies as a result of bites by *Culex pipiens*, L., infected with St. Louis encephalitis [**30** 161]. A table is given summarising the results of attempts to transmit eastern and western equine encephalomyelitis by blood-sucking Arthropods, only the first apparently conclusive result with each species being included, and attempts to recover the viruses from insect hosts infected in nature are reviewed, with particular reference to the recovery of the virus of the western type and also that of St. Louis encephalitis from *C. tarsalis*, Coq., taken at Yakima, Washington, during an epidemic [**29** 194; **30** 191]. This species was not shown to be able to transmit the disease. It is thought that none of the other species tested at the same time, except *Aëdes dorsalis*, Mg., *Anopheles maculipennis freeborni*, Aitken, and *Theobaldia inornata*, Will., was available in sufficient numbers to make a positive result probable. There is conclusive experimental evidence that some species of *Aëdes* can take up, incubate and transmit eastern and western equine encephalomyelitis [**22** 226; **27** 161; **29** 39], but the only one common enough over the whole of the Yakima Valley to play an important part in the spread of the epidemic was *A. dorsalis*, which was represented by the typical form and a light form that has the characters given for *A. campestris*, D. & K., in existing keys, but on the basis of male terminalia and larval characters must be regarded as *dorsalis*. The fact that species of *Aëdes* prefer mammalian to avian blood may account for the failure to find infected individuals of *A. dorsalis*, as birds are the more frequent hosts of the viruses. However, *Aëdes* spp. may transfer to mammals virus acquired in occasional feeds on birds and spread among them virus transmitted in this way or in occasional feeds by *Culex* spp., which often attack birds and may be mainly responsible for the spread of infection among them. *C. tarsalis* is abundant in the Yakima Valley [**29** 195], and the end of its feeding season coincided with the cessation of the appearance of new cases in man and horses. As it hibernates in the adult stage, transmission by it might account for the survival of infection through the winter, which has hitherto been unexplained, hereditary transmission through overwintering eggs of *Aëdes* spp. being considered unlikely. *C. tarsalis* has domestic habits that bring it into close contact with domestic birds and mammals, in which incidence of infection is much higher than in wild species [**29** 194], and this might account for infection being found in it with greater ease. There is no obvious explanation for the failure to find infection in *Anopheles maculipennis freeborni*, Aitken, the other domestic species examined. The importance of *Dermacentor andersoni*, Stiles [**29** 190] and *Triatoma sanguisuga*, Lec. [**29** 38] is limited by their distribution.

"Animal Reservoirs, general epidemiological Summary, and possible Control Measures for the American Summer Encephalitides" by W. McD. Hammon (pp. 37–51) is a detailed account, including additional data, of experiments, a brief report of which has already been noticed [**29** 194].

KELLEY (T. F.). **Mosquito Breeding in certain Cemeteries in Alameda County, California.**—*Proc. 12th Conf. Calif. Mosq. Contr. Ass.* pp. 111–121. Berkeley, Calif., 1942.

Mosquitos have been known for some time to breed in considerable numbers in certain cemeteries in Alameda County, California, and since some of the species concerned are now considered probable vectors of encephalitis and large military posts and war industries have been established in the district, the situation was reviewed. Three typical cemeteries, designated A, B and C, the first two urban and the third rural, were chosen for study. The principal breeding place in all was found to be flower-containers on graves, but the three Anophelines taken in the rural cemetery were all found to be breeding in a neighbouring reservoir formed by damming a stream to provide water for it. Anophelines represented 5–10 per cent. of all the adults caught, and comprised *Anopheles punctipennis*, Say, which was the commonest, and *A. maculipennis*, Mg., vars. *occidentalis*, D. & K., and *freeborni*, Aitken, in the rural cemetery, and two adults of var. *occidentalis* and one of *A. pseudopunctipennis* var. *franciscanus*, McCracken, in cemetery A. The finding of the two varieties of *A. maculipennis* in the same locality and breeding together is of interest [*cf. R.A.E.*, B **30** 154]. The most commonly collected mosquito was *Culex pipiens*, L., which formed 65 per cent. of the total. It was usually breeding in containers holding fairly clean water and never attacked the collectors. The other species of *Culex* taken were *C. stigmatosoma*, Dyar, immature stages of which were taken in all three cemeteries and adults in A and C, *C. tarsalis*, Coq., immature stages and adults of which were taken in A and C, and *C. apicalis*, Adams, represented by three adults, at C. *Theobaldia incidens*, Thoms., formed about 20 per cent. of the total catch and was found in all cemeteries, usually in foul water. It approached to bite in fair numbers in the urban cemeteries at dusk. *T. inornata*, Will., was represented by two adults at A, and *Aëdes varipalpus*, Coq., by a single adult at C.

It is recommended that a reversible flower-container should be introduced, consisting of one container within another, the whole to be sunk into the ground, and the inner one to be emptied and reversed when dead flowers are removed. Oiling the water in the containers is not considered practicable. Specific recommendations are made for the control of breeding in each of the three cemeteries studied.

EMERICK (A. M.). **Mosquito Fish.**—*Proc. 12th Conf. Calif. Mosq. Contr. Ass.* pp. 128–129. Berkeley, Calif., 1942.

A report is given of the establishment of *Gambusia* against mosquito larvae in all the ponds of the Calistoga sewage farm, California. The fish were first introduced into the lowest and cleanest pond in 1933, and as they became acclimatised, they were moved up every six months, until they were established in all the ponds and even in the septic tanks. They are very effective. The edges of the ponds are kept clear of grass by a small flock of sheep. While admitting that fish cannot effectively be used where algae are abundant, the author states that the algae can be controlled by the use of copper sulphate.

REEVES (W. C.). **The Identification of California Mosquitoes.**—*Proc. 12th Conf. Calif. Mosq. Contr. Ass.* Suppl. 14 pp. multigraph, 28 figs. Berkeley, Calif., 1942.

Profusely illustrated keys, designed to serve as an aid to tentative identification in the field, are given to the larvae and adults of the species of *Anopheles*, *Theobaldia*, *Culex* and *Aëdes* occurring in California, and to the larvae and adults of these genera and of *Psorophora*, *Mansonia* and *Orthopodomyia*, each of

which is represented in the State by a single species, as is also *Uranotaenia*, which is omitted from the keys on account of its rarity. The keys to the larvae include notes on breeding habits. The keys are preceded by a list of the species recorded from California.

De León (J. R.). **El anophelismo de altura en Guatemala.** [The Anopheline Fauna at high Altitudes in Guatemala.]—*Bol. sanit. Guatemala* **9** no. 46 pp. 411–424. Guatemala, 1938.

This paper [the original of which has not been received by this Institute] is stated to include descriptions of *Anopheles parapunctipennis* (*chiriquiensis*) var. *guatemalensis*, n. [*cf. R.A.E.*, B **30** 12] and *A. xelajuensis*, sp. n.

Lewis (D. J.), Hughes (T. P.) & Mahaffy (A. F.). **Experimental Transmission of Yellow Fever by three common Species of Mosquitoes from the Anglo-Egyptian Sudan.**—*Ann. trop. Med. Parasit.* **36** no. 1–2 pp. 34–38, 8 refs. Liverpool, 1942.

An account is given of experiments demonstrating the ability of *Aëdes taylori*, Edw., *A. metallicus*, Edw., and *A. aegypti* var. *queenslandensis*, Theo., to transmit yellow fever. The first two attack man readily and are widely distributed in the Sudan and common in the Nuba Mountain District, where an epidemic of yellow fever occurred in 1940 [*R.A.E.*, B **30** 88]. The third is common in the coastal area of the Sudan and is so different in appearance from the typical *A. aegypti*, L., that transmission experiments with it seemed desirable. The methods of collecting, transporting, feeding and maintaining the mosquitos and the experimental technique adopted are described. They were allowed to feed on infected rhesus monkeys (*Macaca mulatta*) when the temperature of the latter had reached at least 104°F. They were kept at a constant temperature of 25°C. [77°F.] and were allowed to feed in batches of 2–25 after intervals of 8–13 days, or in one instance in the case of *A. taylori*, singly 10, 14 and 19 days after the infective meal, on a normal rhesus monkey or on a species of *Cercopithecus*. The nine rhesus monkeys all died of yellow fever, while the two African monkeys recovered and developed immunity from the disease. In one experiment, *A. metallicus* transmitted the virus 8 days after being infected [*cf.* **19** 214], and the incubation period in *A. taylori* in one instance was 12 days.

Blacklock (D. B.) & Wilson (C.). **Apparatus for the Collection of Mosquitoes in Ships, with Notes on Methods of Salivary Gland Dissection.**—*Ann. trop. Med. Parasit.* **36** no. 1–2 pp. 53–62, 8 figs., 6 refs. Liverpool, 1942.

Descriptions and diagrams are given of the electric bicycle-lamp, collecting tubes, tube-carrying box and tube rack that comprise the equipment necessary for collecting mosquitos in ships. As it is important that the equipment should be light, small and easy to carry, the tubes chosen were 2 ins. long and ½ in. in diameter, the smallest size practicable. This made it possible to use a separate tube for each insect and so minimise damage to scale-patterns. Various methods of dissecting the salivary glands are described from the literature, including one devised by the authors, which is simple and gives a clean dissection.

Blacklock (D. B.). **The Prevention of Mosquito-borne Diseases in tropical and sub-tropical Towns.**—*Ann. trop. Med. Parasit.* **36** no. 1–2 pp. 63–74, 5 refs. Liverpool, 1942.

Considering that there was a discrepancy between the findings of the sanitary inspectors of Freetown, Sierra Leone, with regard to Anopheline breeding places and the results of examinations of the population for malaria, the author studied

two pamphlets in which are set out the methods adopted there for the control of mosquito-borne diseases, and concluded that better results might be achieved if the sanitary inspectors were employed in a different manner and if the present procedure with regard to prosecution for infringement of the sanitary laws and regulations was modified. The present organisation is therefore reviewed and commented on, and the European and African staff required to operate a scheme for which a year's trial is proposed and the duties that each would perform are described.

HOPKINS (G. H. E.). **"Mosquitoes of the Ethiopian Region"—Notes and Corrections.** VAN SOMEREN (E. C. C.). **Appendix. Two new East African Culicine Larvae.**—*Bull. ent. Res.* **33** pt. 3 pp. 175–179, 1 fig. London, 1942.

Notes are given on corrections necessary in the three volumes of "Mosquitoes of the Ethiopian Region" [*R.A.E.*, B **24** 123; **26** 182; **29** 114]. These are to the keys to the adults of *Finlaya* and to the larvae of *Anopheles, Uranotaenia, Aëdes* and *Culex*. The last two keys are amended to include larvae of additional species, two of which (one in each genus) are described in the appendix.

HARRIS (W. V.). **Notes on Culicine Mosquitos in Tanganyika Territory.**—*Bull. ent. Res.* **33** pt. 3 pp. 181–193, 1 fig., 10 refs. London, 1942.

Further records of Culicine mosquitos were obtained in Tanganyika Territory in 1941 in the course of work forming part of precautionary measures taken against yellow fever. They are given in this paper together with those published previously [*R.A.E.*, B **8** 164; **13** 39; **16** 22, 115; **17** 71; **18** 201; **29** 114]. The locality in which each species was taken is shown, and in some cases the type of breeding place or of site where adults were found. *Aëdes* (*Stegomyia*) *aegypti*, L., *A.* (*S.*) *simpsoni*, Theo., and *A.* (*S.*) *vittatus*, Big., the species of most importance in relation to yellow fever, are widely distributed throughout the Territory.

Between February and November 1941, inclusive, 986 collections of larvae, other than *Anopheles* and *Culex*, from domestic sources in Dar-es-Salaam and 69 collections from tree-holes were identified from the adults to which they gave rise. *Aëdes aegypti, A. simpsoni, A.* (*Stegomyia*) *metallicus*, Edw., *A.* (*Diceromyia*) *adersi*, Edw., and *Eretmapodites quinquevittatus*, Theo., were found in 975, 6, 6, 2 and 3 of the domestic collections, respectively. The breeding places of *A. aegypti* included a variety of domestic utensils and other small collections of water. Of the collections made in tree holes, *Aëdes aegypti, A. simpsoni, A. metallicus, A. adersi, A. fulgens*, Edw., and *E. quinquevittatus* were found in 53, 15, 23, 4, 1 and 1, respectively. Two or even three species were often found together in the same hole, but larvae were found in only 3 per cent. of the trees inspected.

Experiments were carried out on the value of bamboo pots as trap breeding places for estimating populations of *Stegomyia* [**16** 27]. The pots had an internal diameter of 2–3 ins., and were allowed to stand in the open, filled with stream water, for at least a week before use. They were then hung in batches of 25 for five days in each locality, after which they were removed to a mosquito-proof insectary. Details are given of the records obtained from May to September in three localities in Morogoro township; the rainfall and the fluctuation in each locality in populations of *A. aegypti* and *A. simpsoni*, the only species taken in numbers, are shown in a graph. *A. aegypti* was evident indoors only when it was obtained from at least 10 of 25 pots exposed for 5 days. *A. simpsoni* was hardly ever found indoors. Exposure of pots on an aerodrome 0·7 mile from the nearest native huts indicated that sufficient adults of both *A. aegypti*

and *A. simpsoni* are in movement during the dry season to produce an infestation if suitable breeding places are allowed to exist on the aerodrome, and larvae of both species were found in pots on the border of a forest, although there was no dwelling within a mile.

DAVID (W. A. L.). **Simple Tests for estimating the Suitability of Mineral Oils as Mosquito Larvicides.**—*Bull. ent. Res.* **33** pt. 3 pp. 195–203, 5 refs. London, 1942.

A satisfactory oil for the control of mosquito larvae is nearly always a blend of various constituents, each of which may contribute desirable properties or correct undesirable ones possessed by the others. In this paper, minimum specifications are given for the specific gravity, volatility and viscosity of an oil used for this purpose, and its spreading pressure, the permanence of the film it makes, and its toxicity. Simple tests for determining each of these in a commercially blended larvicide or in the individual ingredients are described. The procedure that should be followed in blending larvicides, and the properties of petroleum products likely to be used as larvicides, are dealt with in appendices.

WIGGLESWORTH (V. B.). **Some Notes on the Integument of Insects in Relation to the Entry of Contact Insecticides.**—*Bull. ent. Res.* **33** pt. 3 pp. 205–218, 6 figs., 20 refs. London, 1942.

The following is largely the author's summary of investigations on the bearing of certain structural and physiological features of the insect cuticle on the entry of insecticides, particularly of extracts of pyrethrum in oil, some of the results of which have already been noticed [*R.A.E.*, B **29** 81].

Insects immersed in oils exude droplets of water on the surface of the cuticle [*loc. cit.*], but there is a delay in their appearance if heavy oils are used that varies in duration at different parts. There is no delay if the lipoid layer of the epicuticle is first extracted with petroleum ether. Factors controlling the rate of entry of pyrethrum through the cuticle were studied by the application of pyrethrum in oil to a restricted area of the abdomen of nymphs and adults of *Rhodnius prolixus*, Stål. The pyrethrum entered more rapidly when in light than in heavy petroleum oils and its rate of entry was much accelerated when the cuticle was first treated with petroleum ether; it was very slow when vegetable oils were used [*cf.* **31** 5]. The rate of entry varied greatly among individual insects, chiefly owing to differences in the thickness of the endocuticle, which is determined by the size of the meal taken before moulting, the age and the amount of food taken after moulting, and the degree of stretching of the cuticle. There is evidence that the pore canals are important in the passage of pyrethrum through the endocuticle, which probably offers the chief resistance.

Histological examination showed that in the nymphs, oils are taken up first by the epidermal cells in the zone round the bristles and later by the general epidermis. The amount of oil absorbed is greatly increased when 5 per cent. oleic acid is added to refined petroleum. In adults that have recently moulted, oils are taken up by the general epidermis, and in old insects they are absorbed only by the dermal glands; there is no evidence of absorption through the sockets of the bristles. The rate of entry of pyrethrum in oils through the cuticle of the nymphs is accelerated by the addition of oleic or other fatty acids, but this effect is less pronounced in the adults.

[KRIVENKO (A. I.).] **Кривенко (А. И.). Moustique malarigène** *Anopheles plumbeus* **Steph. en Kachétie (RSS de Géorgie).** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 498–499. Moscow, 1940. [Recd. December 1942.]

Larvae of *Anopheles plumbeus*, Steph., were taken in six inhabited places in the district of Kakhetia in eastern Georgia in 1934. In most cases they were

found in water in tree holes, together with those of *Aëdes geniculatus*, Ol., or *A. pulchritarsis*, Rond. [*cf. R.A.E.*, B **28** 9], but in one instance, they occurred with larvae of *Anopheles maculipennis*, Mg., in a wooden barrel. A single female was taken early in May in a house while attacking man, but *A. plumbeus* does not often enter houses or remain in them long.

[Goritzkaya (V. V.).] **Горицкая (В. В.). Valeur épidémiologique de femelles printanières de l'*Anopheles maculipennis* Meig. dans les conditions de la région de Dniépropétrovsk.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 500–502, 2 graphs. Moscow, 1940. [Recd. December 1942.]

Observations during eight years in the Province of Dniepropetrovsk showed that some of the overwintered females of *Anopheles maculipennis*, Mg., abandon their hibernation quarters in the first half of March and some in late March or early April, their appearance almost coinciding with the beginning of the spring outbreak of malaria, which is due to relapses and occurs in April–May. The mean April temperature (8·5°C. [47·3°F.]) is, however, too low for the completion of development of the malaria parasite in the mosquitos ; even if some enter warm buildings and become infected, they soon fly out to oviposit in the open. It appears, therefore, that mosquitos that become infected after they have left their hibernation quarters cannot transmit malaria until May, when the temperature becomes favourable. To ascertain whether overwintered females can survive until then, individuals taken between 21st March and 30th May, including some of the first generation, which emerged between 17th and 19th May, were dissected and their oviducts were measured. The measurements showed that a small proportion of the mosquitos taken late in May had oviposited and so must have belonged to the overwintered generation, since the first-generation females could not have matured their eggs before 30th May. It appears, therefore, that some of the overwintered mosquitos live until the end of May, and possibly the beginning of June, though most of them die earlier. The first infected mosquitos found were individuals with immature oöcysts on the stomach on 29th May, and sporozoites occurred in the salivary glands in June. Further south in the Province, mosquitos with mature oöcysts were taken at the end of May. It appears, therefore, that the mosquitos responsible for the first fresh cases of malaria may belong to the overwintered or first generation, but the latter is the more important.

[Popov (V. M.).] **Попов (В. М.). Sur la biologie de l'*Anopheles maculipennis messeae* hivernant dans les locaux habités.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 503–504. Moscow, 1940. [Recd. December 1942.]

Females of *Anopheles maculipennis* var. *messeae*, Flni., have been observed in various parts of the Russian Union to emerge from hibernation in warm rooms and suck blood some time before they appear in the open. In investigations in western Siberia in 1939, large numbers of mosquitos were taken on 27th March in an inhabited house and in the basement of a hospital in a village north-east of Tomsk, and since this is the only variety of *A. maculipennis*, Mg., that occurs in this region, with the exception of a very small proportion of var. *typicus*, it is assumed that they belonged to var. *messeae*. The patients stated that the mosquitos frequently attacked them, and a few very active ones were present in the wards. Of the 76 individuals taken in the living-room and kitchen of the house, 17 (22·4 per cent.) contained blood, and most of these had evidently fed on the day of capture or on the preceding day. A calf was kept in the kitchen, and precipitin tests with blood from eight of the mosquitos showed that five had fed on cattle and one on man ; the results for the other two were negative. In all, 28 mosquitos were dissected ; mature eggs occurred in two of them, but were abnormal in one of these. Of the 15 individuals that

had not yet taken blood, only two contained any considerable amount of fat, and the others had evidently terminated hibernation. Of the seven females taken in the hospital, five contained mature eggs. Mosquitos were not observed in day-time shelters in Tomsk until 25th April. It is concluded therefore that mosquitos in inhabited buildings began to suck blood some two months before they left them, though the females with mature eggs were found as early as 27th March.

[Krasikova (V. I.).] **Красикова (В. И.). Sur le remplissement du jabot chez les *Anopheles maculipennis messeae* gorgés de sang.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 505–507, 1 fig., 1 graph. Moscow, 1940. [Recd. December 1942.]

Females of *Anopheles maculipennis* var. *messeae*, Flni., taken in the Province of Kuibyshev during 1935–37 were frequently observed to have the crop distended with fluid so that it occupied part of the abdomen. Investigations were carried out on individuals taken in hibernation quarters in winter and in day-time shelters in summer. The former were allowed to feed in the laboratory and had access to water. Various degrees of crop distension were observed in these after feeding, and in the summer mosquitos, and the author describes and figures 11 stages in which the portion of the abdomen filled by the crop ranged from one-half of a segment to three complete segments. The percentage showing crop distension increased from May to September in the summer mosquitos, with a slight decrease in July, and decreased during the winter in the hibernating individuals. These findings were confirmed by observations in Kazan in the summer of 1938.

[Blakhov (A. A.) & Kuptzova (A. D.).] **Блахов (А. А.) и Купцова (А. Д.). Le transport des moustiques malarigènes par les navires.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 508–510, 1 graph. Moscow, 1940. [Recd. December 1942.]

Periodical inspection between May and September 1938 of river steamboats arriving at Astrakhan showed that malaria mosquitos [*Anopheles maculipennis*, Mg.] occurred on a high proportion of them [*cf. R.A.E.*, B **26** 46, 219]. The most infested were local boats that plied in the delta of the Volga. The mosquitos were most abundant in June and July and occurred chiefly in quarters in which the passengers were most crowded. No considerable numbers of mosquitos were found in buildings close to the landing-places in the villages and towns at which the boats called. Of 875 mosquitos taken on these boats between 14th July and 25th September, during which period the incidence of malaria in the region usually increases, none was found infected with malaria parasites.

[Shapkin (L. A.).] **Шапкин (Л. А.).** *Gambusia affinis* **et** *Leucaspius delineatus* **dans la lutte contre les larves de l'***Anopheles*. [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 511–514, 1 fig. Moscow, 1940. [Recd. December 1942.]

Gambusia affinis holbrooki, which destroys Anopheline larvae, was introduced into the Province of Dniepropetrovsk (central Ukraine) from Abkhazia in 1934. It multiplied in the summer and survived the winter, but died out in most of the waters in spring, and a study was therefore made of the types of water in which it would thrive. The steppe rivers appeared to provide the most suitable conditions, since they are shallow and have a slow current, sloping banks, a muddy bed and abundant aquatic vegetation. Artificial reservoirs should be at least

40 ins. deep and protected from wind and should have sloping banks, submerged aquatic plants, a rich zooplankton, and a muddy bottom free from hydrogen sulphide ; the presence of springs is desirable. Analysis of the stomach contents of these fish showed that they prefer animal to vegetable food, but are able to survive on protozoa and algae for an indefinite period. They were destroyed by pike and perch, but not by carp. Other natural enemies in the Province include the predacious bug, *Notonecta glauca*, L., which is present in numbers wherever *Gambusia* is abundant, and ducks. Since gravid females were common at water temperatures of 11–12°C. [51·8–53·6°F.], it is suggested that waters infested with Anopheline larvae should be stocked with *Gambusia* in April, so that the first brood would be produced in May. Superfluous aquatic vegetation along the banks should be removed, as it affords shelter to the mosquito larvae. As a result of breeding *Gambusia* under suitable conditions, it was available in large numbers in 1938, and over 600 acres of waters were stocked with it.

Leucaspius delineatus is the most effective of the local fish that feed on Anopheline larvae. Owing to the position of its mouth, it feeds on objects occurring at or near the surface of the water ; it remains near the banks, where mosquito larvae occur, and is very active and voracious. It spawns from April to the end of June, and, unlike *Gambusia*, overwinters in any fresh water that does not freeze to the bottom. Some 25 acres of water were stocked with this fish in 1938. It was found that the most effective rates of release were 5 per 10 sq. ft. for *Gambusia* and 7–8 for *Leucaspius*.

[Smirnov (E. S.).] **Смирнов (E. C.). Le problème des mouches à Tadjikistane.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 515–517. Moscow, 1940. [Recd. December 1942.]

A survey carried out in Tadzhikistan in the summer of 1940 showed that the commonest of the flies associated with man was *Musca domestica vicina*, Macq. *M. sorbens*, Wied., which breeds in faeces and pig dung, was next in abundance and was numerous in open-air restaurants and markets and wherever food is sold in the open. Other flies present in numbers were *Stomoxys calcitrans*, L., *M. autumnalis*, DeG., *M. larvipara*, Schn. & Dzied., which causes much annoyance to cattle and man, *Lucilia sericata*, Mg., which breeds mostly in boxes containing kitchen refuse, and *Chrysomyia albiceps*, Wied. The chief control measure recommended is to dry all horse dung and kitchen refuse by scattering it in a two-inch layer in places exposed to the sun and away from water. Refuse boxes should not be used unless they are fly-proof or are cleared daily. Stables should have brick floors, and the dung should be removed daily and dried in the yard. Pig dung, which does not dry easily, should be treated with larvicides. The pits in latrines should be at least 10 ft. deep, and a fly repellent should be applied to the overground parts. Crude oil should be poured over disused latrines, which should then be filled in with soil.

[Kalandadze (L. P.) & Chilingarova (S. V.).] **Каландадзе (Л. П.) и Чилингарова (С. В.). Contributions à l'étude des mouches de Géorgie (principalement synanthropes).** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 518–520. Moscow, 1940. [Recd. December 1942.]

A list is given of 32 species of flies observed in Georgia, chiefly in association with man in and near Tiflis, together with very brief notes on their local distribution, habitats and frequency. By far the commonest was *Musca domestica vicina*, Macq. ; the typical *M. domestica*, L., was not found.

[DERBENEVA-UKHOVA (V. P.).] **Дербенева-Ухова (В. П.). Influence de la température sur les larves de *Musca domestica* L.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 521–524, 2 graphs. Moscow, 1940. [Recd. December 1942.]

In the experiments described, which were carried out to ascertain the effect of medium and high temperatures on the development of larvae of *Musca domestica*, L., newly hatched maggots were placed in tumblers on fresh dung, which was renewed daily, and kept at a relative humidity of 70–80 per cent. and constant temperatures of 25–43°C. [77–109·4°F.]. The larval stage was shortest (averaging 3·1 days, with a minimum of 2·5) in pig dung at 34°C. [93·2°F.]. In horse dung it averaged least (4 days) at 36°C. [87·8°F.]. It lasted about 7·5 days in pig dung and 6·5 days in horse dung at 25°C., and about 5 days in both at 43°C., which is evidently not the upper thermal limit. Larvae about to pupate endeavoured to leave the dung at 36°C. and above, and the number of individuals that did so increased as the temperature rose. Those that remained pupated, but the percentage mortality among pupae that developed at 36–43°C. varied directly with the temperature. All the larvae pupated and gave rise to normal adults when transferred at the beginning of the prepupal stage from high temperatures to 25°C. Development in pig dung was quicker at all temperatures, except the extremes, than in horse or cow dung, and larvae reared on it were larger. This is thought to be due to the favourable humidity of pig dung, which is intermediate in this respect between the other two.

The effect of temperature on the activity of larvae in the second and third instars and those about to pupate was determined by placing larvae reared at 25°C. on damp filter paper on a cooled or warmed surface and measuring the distance they covered. The range of temperature at which they were active and the optimum for activity were 10–42°C. [50–107·6°F.] and 35°C. [95°F.] for second-instar larvae, 8–45°C. [46·4–113°F.] and 36°C. for the third instar, and 5–43°C. [41–109·4°F.] and 29°C. [84·2°F.] for those about to pupate. The activity of second-instar larvae decreased considerably at temperatures above the optimum, and much more so than that of the third instar; there was no apparent decrease in the activity of the larvae ready to pupate.

[DERBENEVA-UKHOVA (V. P.).] **Дербенева-Ухова (В. П.). Adaptation des larves de *Musca domestica* L. à des hautes températures.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 525–527, 1 graph. Moscow, 1940. [Recd. December 1942.]

Larvae of *Musca domestica*, L., were observed developing in large heaps of horse dung at over 40°C. [104°F.] and occasionally even at 48–49°C. [118·4–120·2°F.], a temperature that appeared to be too high for larval activity in the laboratory [see preceding abstract]. Since the laboratory results may have been affected by the sudden transference of the larvae from moderate to high temperatures, experiments were carried out to ascertain whether they can adapt themselves to gradually increasing temperatures. In the field, the temperature of the horse dung on which the eggs are laid and the larvae begin to develop seldom exceeds 35°C. [95°F.], but if the dung is piled into large heaps, it ferments and becomes heated, so that the temperature just below the surface may be above 40–45°C. by the time the larvae reach the third instar. In the experiments, therefore, eggs were placed at 32–33°C. [89·6–91·4°F.] and the temperature was subsequently increased gradually so that the larvae of the third instar developed at a maximum of 44–48°C. [111·2–118·4°F.].

The adaptation of the larvae was demonstrated by the effect of temperature on their activity and by the rate of mortality. The temperature range of activity and the optimum for it were 12–48°C. [53·6–118·4°F.] and 41°C.

[104·9°F.] for third-instar larvae from the series in which the temperature was raised to 44°C., whereas they were 8–45°C. [46·4–113°F.] and 36°C. [95·9°F.] for similar larvae bred at 25°C. [77°F.]. Thus, larvae reared at the increasing temperature were more tolerant of high temperatures than those kept at 25°C.; they were also more sensitive to a decrease in temperature, which lowered their activity more than it did that of the larvae reared at 25°C. The effect of high temperature on mortality was determined by placing larvae on pans heated to temperatures ranging from 39 to 51°C. [87·8–123·8°F.]. The fatal temperatures varied directly with those at which the larvae had been kept immediately preceding the test, but all the larvae died at 51°C.

The survival of the larvae in the field when the temperature of the dung is high may, therefore, be explained by their adaptation.

[Egorov (P. I.).] **Егоров (П. И.). Essai d'utilisation de la fumigation du sol comme moyen de la destruction des agglomérations de nymphes de mouches.** [*In Russian.*]—*Med. Parasitol.* **9** no. 5 pp. 528–530. Moscow, 1940. [Recd. December 1942.]

An account is given of experiments carried out near Odessa in view of the desirability of finding a soil fumigant that would be effective against pupae of *Ceratitis capitata*, Wied. Since a sufficient number of pupae of this Trypetid were not available, pupae of the house-fly [*Musca domestica*, L.] were collected from refuse dumps and placed in muslin bags at a depth of about 2 inches in the soil of field plots. The fumigants tested were paradichlorobenzene, polychlorides [a mixture of chlorobenzenes] and a preparation called calcium cyanide that contained about 40 per cent. sodium cyanide [*cf. R.A.E.*, A **27** 149], and the soil was covered with paper as soon as they had been applied. The edges of the paper were pressed down with earth, and it was left in place for the period of exposure.

The best results (complete or almost complete mortality in 3 days) were obtained from the use of paradichlorobenzene applied at the rate of 1·2 oz. or more per sq. yd. by strewing it over the surface of the soil or by dissolving it in kerosene and watering the soil with the solution. Since a few pupae gave rise to adults, however, it is considered that the period of exposure should have been longer. The effectiveness of paradichlorobenzene decreased when the pupae were placed at greater depths; it killed many of them at a depth of 8 ins., but not at 16 ins. Polychlorides, applied in holes or poured over the surface of the soil, were effective, but not reliable even at high dosages; it is considered that they would be of value against fly pupae if used at the rate of about 3 oz. per sq. yd., but further tests are required. The cyanide killed up to 99 per cent. of the pupae when used as a 2 per cent. solution in water and applied at the rate of 1·8 or 2·4 oz. per sq. yd., but was unsatisfactory when the dry flakes were introduced into the soil, even if the latter was damp after rain. A bitumen emulsion diluted with water was sprayed over the treated soil as a substitute for paper, but did not give promising results.

It is concluded from these experiments that the fumigants tested could be successfully used for the control of *M. domestica* in refuse dumps and other places where the larvae and pupae occur, provided that they could be satisfactorily covered after the treatment.

[Khelevin (N. V.) & Ruibina (A. D.).] **Хелевин (Н. В.) и Рыбина (А. Д.). Myase de l'oreille chez l'homme provoquée par les larves de** *Musca domestica.* [*In Russian.*]—*Med. Parasitol.* **9** no. 5 p. 531. Moscow, 1940. [Recd. December 1942.]

In a case recorded from central Russia, eight living larvae of *Musca domestica*, L., were extracted from the ear of a boy. He had long complained of pain in the ear, which was suppurating and so had been in a condition that would attract the flies for oviposition.

RICHES (J. H.). **Further Observations on the Relation of Tail Length to the Incidence of Blowfly Strike of the Breech of Merino Sheep.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 1 pp. 3–9, 2 refs. Melbourne, 1942.

Further observations are reported on the results of the experiments begun in Queensland in 1938 and 1939 on the effect of tail length on the incidence of breech strike and tail strike in sheep, an account of which has already been noticed [*R.A.E.*, B **30** 54], and details are given of a third experiment begun in the spring of 1940. None of the sheep used in the first experiment was struck between 17th July 1940 and 20th January 1941, owing to the continued dry conditions. Between the latter date and 17th July 1941, the numbers of strikes per 100 sheep were 13·7 among those with long (4-inch) tails, 33·3 among those with medium tails, and 50·7 among those with short tails, so that the effect of the longer tail in reducing the incidence of strike was permanent. The numbers of strikes per 100 sheep between 20th January and 19th July 1941 in the second experiment were 41·3, 24·8, 60·9 and 90·4 in the groups with undocked, long, medium and short tails, respectively. The results confirmed those of the first experiment, showing that the long tail considerably reduces susceptibility to breech and tail strike while the short tail appreciably increases it, and they also showed that the undocked tail reduces the incidence of breech strike to almost the same extent as the 4-inch tail, but is more frequently struck itself. Only two lengths of tail, long (4 ins.) and short (about 1 in.) were compared in the third experiment, which was begun in October 1940 and included wethers as well as ewes. No strike was recorded between marking in October and crutching in January. Between 1st January and 23rd May 1941, the numbers of breech strikes per 100 sheep with long and short tails were 19·2 and 56·2 in ewes and 2·0 and 3·1 in wethers. Observations in 1941 on the ewes involved in the first experiment failed to reveal any evidence that the long tail reduced lambing perçentages.

MACKERRAS (I. M.), MACKERRAS (M. J.) & MULHEARN (C. R.). **Attempted Transmission of *Anaplasma marginale* Theiler by Biting-flies.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 1 pp. 37–54, 1 fig., 2 pp. refs. Melbourne, 1942.

It is stated that there is little ground for doubt that anaplasmosis is normally transmitted by ticks, and lists are given of 12 species that have been shown to be vectors in various parts of the world and of eight species that have been recorded on cattle in Australia. The latter include *Boophilus annulatus microplus*, Can. (*australis*, Fuller) and *Haemaphysalis bispinosa*, Neum., the only species that occur normally on cattle, and *Rhipicephalus sanguineus*, Latr., which has transmitted anaplasmosis experimentally in America [*R.A.E.*, B **19** 66] and occurs in Queensland and Northern Territory, but usually infests dogs [*cf.* **29** 196, etc.]. *B. a. microplus* is almost certainly a vector in Queensland; *H. bispinosa* occurs further south, in eastern New South Wales. It is known that *Anaplasma marginale* can be transmitted by mechanical means [**19** 67] and by the use of contaminated vaccine, and in the United States, where it occurs well beyond the present limits of distribution of *B. annulatus*, Say, it has been transmitted mechanically by blood-sucking flies [**30** 100, etc.]. A brief survey is given of the literature in which evidence against the theory of transmission by flies is adduced.

As it had been observed that anaplasmosis sometimes occurred in northern Queensland under conditions in which transmission by ticks seemed unlikely, experiments were carried out at Canberra on the ability of *Stomoxys calcitrans*, L., and *Tabanus circumdatus*, Wlk., to transmit a pure strain of *Anaplasma marginale* received from Queensland. These flies were chosen because they

occur both at Canberra and in northern Queensland, were considered likely vectors, and are comparatively easy to handle. They were fed on calves when the latter showed moderate to large numbers of *A. marginale* in the peripheral blood. In experiments on cyclical transmission by *S. calcitrans*, three healthy calves received 288, 586 and 1,239 bites at intervals of 2–9, 8–42 and 8–42 days, respectively, after the infective feed. In experiments on mechanical transmission with the same species, four calves received 99, 417, 252 and 238 bites at intervals of 10–300 minutes, 5–351 minutes, 17–580 seconds and 9–60 seconds after the infective feed. In an experiment on mechanical transmission by *T. circumdatus*, one calf received 119 bites, 10–242 seconds after the infective feed. All the results were negative. In the last two experiments with *S. calcitrans* and the one with *T. circumdatus*, 45, 149 and 71 bites, respectively, occurred within 30 seconds of the infective feed and 103, 88 and 32 between 30 and 60 seconds after it. It is considered extremely doubtful whether, under the most favourable conditions in nature, *S. calcitrans* would resume feeding in less than 10 seconds, and all Tabanids take much longer to do so.

Entomological Investigations.—*15th Rep. Coun. sci. industr. Res. Aust. 1940–41* pp. 17–27. Canberra [1942]. **Animal Health and Nutrition Investigations.**—*T. c.* pp. 27–34.

During 1940–41, the Divisions of Economic Entomology and of Animal Health and Nutrition continued their work on sheep blowflies [*cf. R.A.E.*, B **30** 30]. Eight dressings were compared on either artificially produced or natural crutch strikes, which were dressed and exposed to a fairly dense population of *Lucilia cuprina*, Wied., under highly favourable conditions. The two containing boric acid, tar oil and bentonite (B.T.B. 15 and B.T.B. 30 [**30** 53]) and the emulsion of boric acid and camphor oil [**28** 103] were far superior to the others. B.T.B. did not deter females from ovipositing, but killed the young larvae and the females, so that the dressed sheep acted as poison baits. In comparative studies of the repellency of various essential oils, which were applied as 10 per cent. solutions in liquid paraffin in rings about $\frac{1}{2}$ inch wide round an attractant plug on the fleece [**29** 50], Java citronella oil was less effective than Ceylon citronella oil, and none of the eight constituents of the Ceylon oil so far tested was as repellent as the oil itself. Three of four fractions into which the Ceylon oil was divided by fractional distillation were less effective, while the fourth, though no more effective than the whole oil, is being examined further. Camphor oil was considerably less repellent than Ceylon citronella oil. Of eight Australian essential oils, the most promising were zieria and huon pine [*Dacrydium*]. Three samples of eucalyptus oil from various sources exerted no repellent effect at all. In trials on the effectiveness of Mules' operation when performed on lambs at marking time, it was found that a proportion of the lambs (less than 10 per cent. in the trial reported here) always require re-treatment and more skill is required to perform the operation on lambs than on older sheep. Ten weeks after treatment, about 4 per cent. of the lambs that had been operated upon were struck and most of these needed re-treatment, while in a group of lambs that had not been treated because they appeared to be plain-breeched, 20 per cent. were struck. In a trial on weaners in which one group of plain-breeched sheep was left untreated, one of B and C class sheep [**28** 103] was operated on and another similar group was left untreated, the aggregate strike percentages were 11, 1 and 59, respectively.

Of 18 sheep carcasses exposed to infestation at monthly or half-monthly intervals throughout the year, only six produced any adults of *L. cuprina* and the maximum number from any one was 45. In a further experiment in which the effect of predators and parasites was eliminated, less than a thousand adults were produced by any one carcass, although the incidence of strike in the field

during the season was high, and trapping records showed the population of *L. cuprina* to be ten times higher than usual. High carcass temperature (between 100 and 115°F.) produced by intense larval activity was thought to be one of the factors responsible for the small number of primary flies produced. Further work on the prevention of breeding in baits showed that borax sprinkled over the surface prevents larval development and also renders the bait poisonous to the adult, though death may not occur for 40 hours after feeding. The addition of the borax slightly reduces the attractiveness of the baits, but prolongs the catching period.

The results are given of investigations on the physiology of *L. cuprina*, particularly the production and excretion of ammonia by the larvae and its distribution in their organs and tissues. Its production appears to be due to hydrolytic deamination of adenosine and to some extent of guanine and of higher polypeptides and is inhibited by sodium sulphide, iodoacetic acid, boric acid and salts of iron and copper. The larvicidal action of boric acid for *L. cuprina* may be explained by its inhibition of this important enzyme system; other well known larvicides have no effect on deaminase. To measure the rate of penetration of substances through insect cuticle, cuticular sacs, obtained by removing the haemocoele contents of fully grown larvae, were filled with pH indicators or spot test reagents and the ends sealed. The time taken for various solutions in which the sacs were immersed to penetrate could be determined by colour changes. Copper and barium ions did not penetrate the cuticle for at least a week; and of the alkalis tested, sodium hydroxide and potassium hydroxide proved most effective. Immersion at 25°C. [77°F.] for 10 minutes in a number of dressings and various essential oils did not cause high mortality of larvae, and most of the fully-grown ones leaving a recently dressed strike were able to develop to the adult stage. It was shown by the contact toxicity technique [**29** 103] that 0·4 per cent. arsenious oxide, with or without wetting agents, was completely non-toxic to prepupae immersed for 30 minutes at 23°C. [73·4°F.]. Application of the rate-of-mortality technique [**29** 102] for measuring stomach toxicity showed that αα′-dipyridyl is almost as toxic as nicotine, to which it is structurally related. Dinitro-o-cyclohexylphenol and proflavine are slightly toxic. Sulphanilamide, sodium diethyldithiocarbamate, quinhydrone and iodoacetic acid are non-toxic at a concentration of 0·2 per cent. in the enriched medium.

Liver in the later stages of decomposition was the most effective of a number of baits tested for *Musca pumila*, Macq. (*vetustissima*, Wlk.), which occurs commonly during the warm months and isolated individuals of which have been bred from dung or carrion.

Preliminary investigations on the bionomics of the cattle tick, *Boophilus annulatus microplus*, Can. (*australis*, Fuller), which was proving difficult to eradicate in northern New South Wales, showed that the non-parasitic stages are very sensitive to changes of humidity. The number of eggs deposited and the percentage hatch appeared to increase with humidity. No eggs hatched when kept at 70 per cent. relative humidity and 21·5°C. [70·7°F.]. The threshold of development appeared to be 15 or 16°C. [59 or 60·8°F.]. Replete females are very difficult to wet with arsenical dips. Painting various parts of the body with a solution of sodium arsenite and soap indicated that absorption takes place quite readily through the dorsal surface. This solution caused total mortality in 24 hours, whereas some ticks painted with sodium arsenite alone lived two or three days.

When myxomatosis was introduced into four out of 13 warrens over an area of 90 acres in which were some 500 rabbits infested by *Echinophaga myrmecobii*, Roths. [*cf.* **30** 31], the disease spread to all the warrens, and within 70 days all except 17 of the rabbits were dead. These were caught and proved to be susceptible. The disease had died out when the population was so low that spread had become difficult or impossible.

BRUCE (W. G.). **Zinc Oxide: a new Larvicide for Use in the Medication of Cattle for the Control of Horn Flies.**—*J. Kans. ent. Soc.* **15** no. 3 pp. 105–107, 5 refs. Manhattan, Kans., 1942.

In experiments continued in 1940 and 1941 on the internal treatment of cattle to render their droppings unsuitable for the development of larvae of *Lyperosia* (*Haematobia*) *irritans*, L. [*R.A.E.*, B **28** 208, etc.], zinc oxide, a very fine odourless, tasteless, amorphous white powder, administered in moist bran at the rate of at least 1·5 gm. per 100 lb. body weight rendered the droppings larvicidal for 24 hours, beginning 20 hours after administration. Animals remained in good condition after as many as 20 consecutive daily doses, and never hesitated to eat the bran. Zinc oxide is inexpensive and commonly available. When it was mixed directly with the droppings, the minimum lethal dose was one part to 10,000. Zinc oxide in droppings had no ovicidal effect.

CUTHBERTSON (A.). **The Skin Maggot Fly. Life History and preventive Measures.**—*Rhod. agric. J.* **39** no. 3 pp. 149–151, 2 pls., 2 refs. Salisbury, S. Rhod., 1942.

A brief account is given of the life-history of *Cordylobia anthropophaga*, Grünb., mostly taken from a paper already noticed [*R.A.E.*, B **12** 28]. The adults, which are active from December to March in Southern Rhodesia, rest in dark places in houses, verandahs and native quarters by day, and are seldom seen. A single female may lay as many as 500 eggs, which are deposited singly just under the surface of sandy soil that has been contaminated with urine and excreta or sometimes in clothing out of doors, but never directly on the skin. The egg stage lasts 2–3 days. The newly hatched larvae are very active, and as soon as they have found a suitable host they begin to bore under the skin, feeding on the living tissue, and producing first a small red papule and later a painful tumour. They can live 1–2 weeks without food if they fail to find a suitable host. There are three larval instars, and the whole stage lasts 8–9 days in man and a day or two less in rats. The mature larvae fall to the ground and pupate near the surface of the soil, and the adults emerge about 2 weeks later. The most frequently infested domestic animals are dogs and guineapigs. Infants and young children are more often attacked than older persons.

THORPE (W. H.). **Observations on** *Stomoxys ochrosoma* **Speiser (Diptera Muscidae) as an Associate of Army Ants (Dorylinae) in East Africa.**—*Proc. R. ent. Soc. Lond.* (A) **17** pt. 4–6 pp. 38–41, 12 refs. London, 1942.

When in Tanganyika Territory in 1939, the author observed that a female *Stomoxys* hovered about an inch above a marching column of the army ant, *Dorylus* (*Anomma*) *nigricans* var. *molestus*, Gerst., and dropped a large egg, or possibly a newly hatched larva, with great precision in front of a worker returning without booty, which immediately carried it off towards the nest. The fly was caught and subsequently identified as *S. ochrosoma*, Speis. (*flavida*, Mall.); this species has been recorded as feeding on the blood of mammals, as do the other members of the genus, and in describing it, Speiser stated that two females had been observed hovering over Doryline ants. An examination of the abdominal contents of the female caught by the author and of females of a number of closely related species indicated that *S. ochrosoma* is ovoviviparous and that it lays a smaller number of larger eggs than do its nearest relatives, which appeared to have simple oviparous habits. The ovarian egg of *S. ochrosoma* measures 1·2 by 0·4 mm., but the extruded egg appeared about double this size. There is no such increase in the size of the egg in *S. calcitrans*, L., the only member of the genus the breeding of which has so far been investigated.

ILLINGWORTH (J. F.). **Feeding Habits of** *Bufo marinus*.—*Proc. Hawaii. ent. Soc.* **11** no. 1 p. 51. Honolulu, 1941. [Recd. December 1942.]

Examination of the excreta of toads (*Bufo marinus*) in a fish pond in Kaimuki, Hawaii, for five weeks beginning on 1st March 1940 showed that their principal food was *Pycnoscelus surinamensis*, L., which formed 40–90 per cent. of the whole. This cockroach is important in the tropics as an intermediate host of eyeworms [*Oxyspirura*] of fowls [*R.A.E.*, B **16** 263 ; **26** 153, 252, etc.].

ZUKEL (J. W.). **The insecticidal Action of Phenothiazine.**—*Science* **96** no. 2495 p. 388, 4 refs. Lancaster, Pa., 1942.

An investigation showed that phenothiazine [thiodiphenylamine] is toxic to *Periplaneta americana*, L., by contact, but not when ingested. When applied to the body surface, it passes through the exoskeleton and is converted internally to a compound believed to be a conjugate of thionol, present in leuco form. The latter compound must reach a definite concentration in the haemolymph before the toxic effect is produced. The effective concentration of the thionol conjugate in the haemolymph is correlated with the particle size and with the quantity of phenothiazine in contact with the exoskeleton. The most rapid kill at the lowest concentration is produced with particles of the smallest size. When an equal amount of phenothiazine in a larger particle size is in contact with the body surface, the lethal concentration of the thionol conjugate in the haemolymph is not reached. In this case only a slight uncoordinated leg movement is evident, and recovery is rapid as the thionol conjugate is eliminated through the Malphigian tubules.

Ingested phenothiazine has no effect upon the cockroach, although undergoing oxidation primarily during its passage through the mid-intestine. The wall of the intestine is impermeable to phenothiazine and to the oxidation products formed.

EAGLESON (C.). **Effect of Temperature on Recovery of Houseflies.**—*Soap* **18** no. 6 pp. 115–117, 141, 4 graphs, 2 refs. New York, N.Y., 1942.

As fly-sprays in which the toxic agent is pyrethrum or butyl carbitol thiocyanate (Lethane) fail to kill all insects that are stupefied by them, the effect of temperature on the recovery of house-flies [*Musca domestica*, L.] from the effects of sub-lethal doses of these substances was investigated. A ventilated spray tunnel and recovery cabinet were used [*cf. R.A.E.*, B **28** 240]. The dosages applied and dilutions employed are given. The hypnotic dose [**29** 185] as applied was about one-third of the minimum customary in commercial sprays. Observations were made $\frac{1}{4}$, $\frac{1}{2}$, 1, 2 and sometimes 3 and 4 hours after treatment, and the results were examined by the method of probits [A **22** 440 ; **23** 493]. After treatment with pyrethrins, the percentage of flies torpid in 0·7 hours became progressively less as the temperature increased from 22 to 38°C. [71·6 to 100·4°F.], whereas after Lethane, the percentage decreased more gradually from 22 to 30°C. [86°F.], after which it remained practically constant. The two sprays were equally effective at 34°C. [93·2°F.]. It is concluded from a study of the recovery curves that these substances resemble narcotics in action and that a dose that will produce complete torpor is considerably lower than a lethal one. The addition of a secondary substance that would prevent recovery from torpor is considered a promising alternative to the use of higher concentrations of the original substance.

CAMPBELL (F. L.). **Pyrethrum vs. Roaches.**—*Soap* **18** no. 5 pp. 90–93, 103, 105 ; no. 6 pp. 119, 121, 123, 125, 127, 141 ; 2 figs., 82 refs. New York, N.Y., 1942.

The literature on the toxicity of pyrethrum to cockroaches is reviewed and discussed, and a list is given of aspects of the subject into which further inquiry

is considered desirable. It is then pointed out that as the susceptibility of different kinds of insects to pyrethrum varies, pyrethrum insecticides designed for use against cockroaches should be tested against cockroaches. The importance of being able to reproduce test procedure is stressed, and various methods of testing pyrethrum powder, powders impregnated with pyrethrum extract, and solutions of pyrethrum extract are reviewed. It is stated that recommendations on pyrethrum for the control of cockroaches, which have been made since 1896, are founded only on general experience, as no experimental data are available, and a method of making an adequate test in an infested room is suggested. The degree of infestation in the room is estimated by flashlight photographs at night, infested crevices are located by the use of a weak pyrethrum spray in the daytime, and the construction of outside and inside walls and floors is noted. Air-floated pyrethrum powder containing 1·3 per cent. pyrethrins is then applied to the cracks in the daytime by a power duster the rate of output of which is known. Observers take timed notes on the behaviour and condition of cockroaches in the room and its surroundings, and frequent inspections are made to determine remaining infestations. It is pointed out that the degree of control obtained with pyrethrum will depend on the nature of the hiding places and the placing of the insecticide so that the cockroaches will be dusted directly or become dusted as they attempt to move through the crack. Ways of facilitating the contact of the cockroaches with the pyrethrum are discussed. It is thought desirable to lay down a thick band of pyrethrum powder all round the floor near the walls of an infested room and then dust or spray the cracks. The author believes that pyrethrum alone in sufficient quantity will control cockroaches, and that it is of unique importance in view of its harmlessness to man and domestic animals.

GOODWIN jr. (M. H.) & EYLES (D. E.). **Measurements of larval Populations of *Anopheles quadrimaculatus*, Say.**—*Ecology* **23** no. 3 p. 376. Brooklyn, N.Y., 1942.

The authors, who did not know of Cambournac's method [*R.A.E.*, B **27** 233], describe a similar one that they have used for measuring populations of larvae of *Anopheles quadrimaculatus*, Say. Each of a series of unit areas of water surface is enclosed in a frame of planks, six inches deep, and all larvae within the frame are collected with an enamel saucepan. When the flotage has been removed, an inspection for larvae is made of the water surface, particularly the part along the edges of the frame. The main advantage of this method over dipper or pan sampling is that results can be stated as actual density per unit area. By tabulating each sample separately as to instar, statistical treatment can be applied to the results, and the probable population of the whole community can be calculated from the actual populations of the sampled areas. It was found in practice that 10-20 frames of ½–1 sq. m. placed at intersections of grid lines or along spaced lines in a community were sufficient to characterise the population. The chief disadvantage of the method is the time it takes. Its primary value is, therefore, in experimental studies where accuracy is required. It is more useful in dense vegetation and copious flotage than any other method with which the authors are familiar.

TOWNSEND (C. H. T.). **Note on Amazonian *Nyssorhynchus* Races (Dipt.).**—*Rev. Ent.* **13** fasc. 1–2 pp. 150–151. Rio de Janeiro, 1942.

Anopheles (*Nyssorhynchus*) *goeldii*, Rozeboom & Gabaldon, and *A.* (*N.*) *emilianus*, Komp, have both been considered to be possibly identical with the species described [and named *tarsimaculatus*] by Goeldi [*cf.* *R.A.E.*, B **29** 181; **30** 146]. The author states, however, that *A. goeldii* differs from it in habits and characters of the adult and egg and that *A. emilianus* does not enter houses whereas Goeldi's species entered his house in numbers. He concludes that Goeldi's species still lacks a valid name.

VENKAT RAO (V.). **The Effect of stocking Ricefields with Sullage on Anopheline Breeding at Khurda Road.**—*Indian med. Gaz.* **77** no. 4 pp. 214–219, 11 refs. Calcutta, 1942.

In view of the promising results of a preliminary experiment on the stocking of rice-fields on the Khurda Road, Orissa, with sullage during the dry season to control the breeding of Anophelines in the subsequent rice-growing season [*R.A.E.*, B **29** 139], a further experiment was carried out on a large scale to confirm the previous findings and ascertain the effects of the measure on the rice crop. Ten contiguous fields beside the main sullage outfall drain were chosen, alternate ones being stocked with sullage and left as controls. Sullage was let into the experimental fields to a depth of ½–1 in., at weekly intervals between 17th February and 17th May 1941. The results of chemical examinations of the sullage at the time of stocking in February and May are given in a table. They disclosed a complete absence of nitrates, and as this was attributed to the fact that the complex nitrogenous organic matter in the crude sullage had not yet been subjected to bacterial action, which would reduce it to nitrates, samples of soil from one treated and one control field were examined on 28th May and were found to contain 0·68 and 0·12 part nitrates in 100,000, respectively. The fields became dry 2–3 days after the sullage was let into them, so that breeding of *Culex fatigans*, Wied., was impossible. Rice was sown in all the fields about the middle of June, when the south-west monsoon set in. Irrigation was by rain-water only. In each of the fields, 4 samplings for larvae were made in July, August and September, 3 in October and 2 in November, 25 ladle dips being made at the edges of each field on each occasion. The Anophelines found were *Anopheles barbirostris*, Wulp, *A. hyrcanus*, Pall., *A. subpictus*, Grassi, *A. vagus*, Dön., *A. tessellatus*, Theo., *A. culicifacies*, Giles, *A. aconitus*, Dön., *A. varuna*, Iyen., *A. annularis*, Wulp, and *A. pallidus*, Theo., the numbers of each taken being 1, 183, 1,041, 330, 0, 14, 0, 0, 10 and 0, respectively, in the treated fields, and 15, 239, 667, 189, 3, 92, 76, 4, 315 and 11, respectively, in the control fields. The first five species are not vectors of malaria; there is evidence that *A. culicifacies* is not one in the experimental area [*cf.* **25** 191] and *A. pallidus* is unimportant; *A. aconitus* was found infective at places 60 miles north and 22 miles south of Khurda Road, and *A. varuna* is a carrier in other parts of east-central India. The main vector in the area is *A. annularis*, which can maintain hyperendemic conditions with a low sporozoite rate on account of its very large numbers. There was thus a substantial reduction in the numbers of all vector species in the treated fields. The crop from them was nearly 25 per cent. higher than that from the control fields, and the measure also had the effect of providing a satisfactory means of disposing of sullage under rural conditions and controlling *C. fatigans*, and through it filariasis [*Filaria bancrofti*], without the use of oil.

ROY (D. N.), GHOSH (S. M.) & CHOPRA (R. N.). **Comparative Efficacy of different Culicifuges under Laboratory Conditions.**—*Parasitology* **34** no. 2 pp. 152–154, 1 ref. London, 1942.

An account is given of experiments with repellents against females of *Aëdes aegypti*, L., *Armigeres obturbans*, Wlk., *Anopheles stephensi*, List., and *Culex fatigans*, Wied., more than three days old. The mosquitos were given raisins and water, but food was withdrawn 18 hours before a test was made. The preparations were smeared on to both sides of the hand and forearm, which were then introduced into a cage of mosquitos. When the mosquitos showed little inclination to approach, an untreated arm was introduced as a control. The 22 preparations compared were citronella oil or lemon-grass oil alone or in combination with coconut oil or with pyrethrum extract (Pyrocide 20) in kerosene and coconut oil in varying proportions, Pyrocide 20 in kerosene, coconut oil, turpentine, kerosene, pyrethrum ointment in vaseline, methyl salicylas in

liquid paraffin or kerosene, sesame oil, carbon tetrachloride, naphtha, benzene and creosote in liquid paraffin. The last four were the only ones that had no repellent properties. The best results were obtained with a thin film of a mixture of 20 parts lemon-grass oil, 30 parts Pyrocide 20 in kerosene (1 : 20), and 50 parts coconut oil, which was effective against *Aëdes*, *Armigeres*, *Anopheles* and *Culex* for 205, 228, 270 and over 330 minutes, respectively. Almost equally good results were obtained when citronella oil was substituted for lemon-grass oil. Pyrocide 20 in kerosene (1 : 20) alone was the next most effective. The importance of supplementing laboratory tests by field ones in view of the difference of the behaviour of the mosquitos in captivity and in nature and of the effect of a breeze on the volatilisation of the preparation is stressed. It is thought, however, that the laboratory tests may give a good indication of the effectiveness of a preparation used indoors against *Aëdes aegypti*, which bites man readily.

WATKINS (C. V.) & HARVEY (L. A.). **On the Parasites of Silver Foxes on some Farms in the South-west.**—*Parasitology* **34** no. 2 pp. 155–179, 5 figs., 12 refs. London, 1942.

The parasites observed in an examination of the carcasses of 154 silver foxes (from most of which the pelts had been removed) from 15 farms in south-western England and 13 red foxes included the following Arthropods : *Otodectes cynotis*, Hering, *Demodex folliculorum*, Simon, *Linguatula serrata*, Froel., *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., *Spilopsyllus cuniculi*, Dale, one individual each of *Ceratophyllus* (*Monopsyllus*) *sciurorum*, Schr., and *Ixodes ricinus*, L., and one egg of *Trichodectes vulpis*, Denny. *O. cynotis* was prevalent on almost all farms at the beginning of the investigation, but as a result of the diagnosis and consequent routine dressing of ears on all farms, it had become noticeably less frequent by the end of the period. Only one case of follicular mange was observed, but occasional individuals of *D. folliculorum* were found in ear scrapings. *L. serrata* was found only once, in the gut of a red fox. Fleas were found only twice in the pelts of red foxes. The tick and the louse egg were also on the wild foxes. The comparative absence of ectoparasites from these animals is important, as such parasites might be expected to be readily transmissible to silver foxes. It is pointed out, however, that there was time for many ectoparasites to leave the carcasses during transit.

MELLANBY (K.). **Natural Population of the Head-louse (*Pediculus humanus capitis* : Anoplura) on infected Children in England.**—*Parasitology* **34** no. 2 pp. 180–184, 2 figs., 8 refs. London, 1942.

In an examination of the heads of 45 boys and 48 girls under 14 years of age, known to be infested with *Pediculus humanus capitis*, DeG., when admitted to a hospital in an industrial city in the north of England, between November 1939 and October 1940, 1,180 nymphs, 121 adult males and 76 adult females were collected. The average number of lice per child was 12·7 for boys and 16·8 for girls. The highest population found was 142, but 69 per cent. of the boys and 60 per cent. of the girls had less than 10 lice each [*cf. R.A.E.*, B **30** 20]. Among children 1–4 years old, the degree of infestation was the same in girls and boys, but among the older children, particularly those between 5 and 8 years old, heavy infestations were commoner among girls. In 79 per cent. of the cases, all stages of the lice were present, indicating that the infestation had probably existed for at least a fortnight or that several separate infestations had occurred. Long-established light infestations must have been kept under control by the efforts of the host. It is thought that persons harbouring small populations contribute to the spread of infestation, as the lice removed in combing probably remain alive on combs or elsewhere to infest other persons in the building. There was no apparent variation in the frequency with which light or heavy infestations occurred at different seasons [*cf.* **29** 100].

McKenny-Hughes (A. W.). & Johnson (C. G.). **The Bed-bug. Its Habits and Life History and how to deal with it.**—*Econ. Ser. Brit. Mus.* (*Nat. Hist.*) no. 5 (5th edn.), iv+20 pp., 1 col. pl., 7 figs. London, 1942. Price 6*d*.

This new edition of a pamphlet previously noticed [*R.A.E.*, B **26** 39, etc.] on the bionomics and control of *Cimex lectularius*, L., is revised to include precise information on the procedure to be followed in fumigating with heavy coal-tar naphtha [*cf.* **28** 72, etc.]. The quantity recommended is 1½–2 gals. per 1,000 cu. ft. of air space.

Report of the Committee on Bed-bug Infestation 1935–1940.—*Spec. Rep. Ser. Med. Res. Coun.* no. 245, 64 pp., 9 figs., 6½ pp. refs. London, H.M.S.O., 1942. Price 1*s*.

The investigations on *Cimex lectularius*, L., described in this symposium were undertaken to solve some of the problems raised in the Report on the Bed-bug issued by the Ministry of Health in 1934 [*R.A.E.*, B **22** 131].

The first paper, " Ecology of the Bed-bug : Summary of new Knowledge," by P. A. Buxton & C. G. Johnson (pp. 6–17, 8 figs.) is a concise account of Johnson's findings in experimental work carried out over a period of five years [*R.A.E.*, B **28** 212, 233 ; **30** 132, etc.].

In " Chemical Properties of Insecticides, in Relation to the Control of Bed-bugs," by J. W. Munro & A. B. P. Page (pp. 18–26), the qualities required in an insecticide for the control of the bed-bug are reviewed and the toxicity of some is discussed. Gough found that sulphur dioxide is a poor ovicide [**26** 77], is not very lethal to nymphs [**28** 149] and must be used repeatedly if it is to be effective. Moreover, its bleaching and corrosive properties render it unsuitable for use as a general fumigant. The toxicity of pyrethrum and the alkyl thiocyanates is very variable and much more research on them is required. The bulk of the paper deals with heavy coal-tar naphtha. Samples of this complex substance from different sources varied in constitution and toxicity, although conforming to the original specification [**25** 178]. Its constituents and fractions were found to differ in toxicity, and the combined effect of the constituents was greater than the sum of their individual effects. The toxicities to first-instar nymphs of certain components were in the order : xylene > styrene > pseudocumene = mesitylene > indene = coumarone > mixed paraffins, and those to the egg were similar except that indene came immediately after xylene. The early fractions containing toluenes and xylenes were the most toxic. A series of binary synthetic mixtures of mixed paraffins, aromatics, unsaturated compounds and phenols was investigated. When paraffins were mixed in varying proportions with the other substances, they exerted a diluent action on all except indene (an unsaturated compound) and phenols [*cf.* **29** 80]. It was found in a study of the relative susceptibility of the various stages of the bed-bug to a sample of heavy naphtha that the first three nymphal instars were approximately equally susceptible, and that the later instars and the adult became progressively less so. The adult female was more susceptible than the male, and the resistance of the egg was the same as that of the fourth-instar nymph. Sufficient knowledge of the insecticidal behaviour of most of the constituents of heavy naphtha, both by themselves and in combination, has been obtained to justify the Committee in specifying the characters of a heavy naphtha that will be reasonably uniform in action. This naphtha is not the usual fraction of coal-tar light oil termed heavy naphtha by the gas industry, but a fraction of slightly lower boiling range, modified by the addition of carbolic acid containing 90 per cent. cresols. A review is given of various aspects of work on the ventilation necessary after fumigation with hydrocyanic acid gas [**27** 251], and recommendations are made for its safe application. These recommendations, in which the need for carrying out fumigation on scientific lines is emphasised, form a basis for the regulation of

fumigation practice. The Home Office has recently issued certain statutory rules and orders regulating fumigation with this gas.

In "Development of Methods for disinfesting Houses and Furniture," by S. A. Ashmore & A. W. McKenny-Hughes (pp. 26–36), the insecticides in use in 1935 for the control of bed-bugs are reviewed. These are hydrocyanic acid gas, which is very dangerous, sulphur, which is not very effective, and orthodichlorobenzene, which is effective and was previously thought to be safe at a concentration of 0·02 per cent. v/v, but has now been found to be dangerous [**27** 62] at concentrations as low as 0·005 per cent. v/v. In view of this, individual coal-tar hydrocarbons were investigated, in an attempt to find an effective and safe substitute. The whole fraction known as heavy naphtha, which is readily available, was found to be more effective. Details are given of the technique of using the naphtha vapour to disinfest houses, together with an account of an experiment in which the advantage of using cotton screens [**27** 63] and delayed action sprinklers [**28** 72] was demonstrated. The composition of heavy naphtha in relation to toxicity to bed-bugs is discussed, and a specification is given which is similar to, but not identical with, one already noticed [**30** 56]. It was concluded from experiments on the effect of climatic conditions that a room temperature of as much as 70°F. at the end of fumigation will not ensure the presence of a lethal concentration of vapour unless steps have been taken to make good diffusion losses, and that, under adverse conditions, such as high wind, 1 gal. naphtha per 750 cu. ft. [**25** 178] may be insufficient. Since weather may change while fumigation is in progress, it is recommended that the quantity should be increased to 1½–2 gals. per 750 cu. ft. and additional horizonal screens used. The technique is summarised. Heavy naphtha was found to be suitable for the fumigation of furniture and bedding in vans fitted with heaters. Certain organic thiocyanates may be used as contact insecticides where fumigants are impracticable, owing to impossibility of evacuating the premises or similar causes. A list is given of problems on which further research might usefully be undertaken.

In "Domestic Hygiene in the Prevention and Control of Bed-bug Infestation," by W. C. Gunn (pp. 36–42), the importance of cleanliness and good ventilation is stressed and the necessity for a knowledge of the life-history and habits of the bug, the chief features of which are briefly reviewed, is pointed out. Exhibitions of household pests are suggested ; and, though house-to-house inspections are impracticable, sanitary inspectors should be able to recognise the presence of bugs wherever their duties may lead them. Demolition of very heavily infested and defective houses should be considered, but this is not necessary in most cases, and scrubbing with soap and water and possibly lysol, movement of woodwork and use of the blowlamp, removal and restoration of cracked and infested plaster and removal of infested wallpaper are recommended as appropriate. Upholstered furniture should be vigorously cleaned and sprayed with a good contact insecticide. The procedure to prevent infestation of new property that forms part of the routine of rehousing in one large city, and the methods of exercising supervision after the new house or flat is occupied are outlined.

"Investigation of the Toxicity to Man of Insecticides used against the Bed-bug," by G. R. Cameron (pp. 43–50, 1 fig.) includes information on the points to be determined in investigating the toxicity of sprays or fumigants to man, precautions to be taken in carrying out such experiments on animals, the ways in which the substances may be experimentally introduced into the animal's body and the inferences that may be drawn from the tests. It is concluded from investigations during the last four years that orthodichlorobenzene, even in low concentrations, is dangerous, heavy naphtha can probably be used with impunity provided the precautions laid down are observed, the handling of undiluted Lethane 384 (butyl carbitol thiocyanate) and lauryl thiocyanate needs care, but little danger is to be apprehended from the diluted solution of the latter.

"Building Design in Relation to Bed-Bug Infestation (with a Note on Air-raid Shelters)," (pp. 51–53) deals with the designing and constructing of houses so as to afford as little harbourage as possible and facilitate disinfestation should the need for it arise. It is recommended that air-raid shelters should be built with as few cracks and crevices as possible and that all woodwork from demolished houses used in their construction should be treated before use with an emulsion of cresol in soap and water or preferably with a solution of cresol in heavy coal-tar naphtha ; that those in charge of shelters should know how to detect infestation in its early stages and how to deal with it ; and that when a shelter is found to be infested, an organised system of cleaning and scrubbing with soap and water containing cresol and application of a painter's blowlamp to cracks should be instituted, or cracks and crevices may be sprayed with a 5 per cent. solution of cresol in heavy coal-tar naphtha or a solution of 1 part lauryl thiocyanate in 64 parts of heavy white oil.

The report concludes with the following appendices : A selected Bibliography of the Bed-bug, compiled by J. Smart ; Ministry of Home Security Instruction regarding Treatment of Interior Surfaces of Air-raid Shelters against Bed-bug Infestation (Circular CE/GEN/46) ; and Recommendations by the Bed-bug Infestation Committee of the Medical Research Council on the use of Insecticides against Bed-bugs in Air-raid Shelters [**30** 55].

[RODIONOV (Z. S.).] **Родионов (З. С.). The qualitative and quantitative Damage caused by Grain Mites.** [*In Russian.*]—*Uchen. Zap. mosk. gosud. Univ.* no. 42 Zool. pp. 141–165, 3 figs., 16 refs. Moscow, 1940. [Recd. December 1942.]

This paper, the main contents of which have been noticed elsewhere [*R.A.E.*, A **31** 70], includes a section (pp. 159–163) on the effect of mites on the skin and internal organs of man. The literature on the occurrence of Tyroglyphid mites in human faeces [*cf.* B **9** 60 ; **16** 219] and on cases of asthma and irritation of the skin due to *Pediculoides ventricosus*, Newp. [*cf.* **11** 205, etc.] is briefly reviewed, and an account is given of a case in which *Rhizoglyphus echinopus*, Fum. & Rob. (*hyacinthi*, Banks) infested onions stored on shelves in peasants' huts in the Province of Penza and dropped in numbers from the shelves and caused dermatitis in the inhabitants ; the action of this mite on the skin was confirmed in subsequent experiments [**18** 164]. It is pointed out that the occurrence of living mites in human faeces and urine has not been confirmed by recent investigations. It appears that mites may penetrate with food into the human stomach, but they soon die there and only their chitinous remains are evacuated. In experiments in which mice and sparrows were fed on cultures of mites in flour or grain, only a few eggs of *Tyroglyphus farinae*, DeG., survived passage through the digestive tract, all the other stages, including hypopi, being killed [but *cf.* A **31** 75].

In experiments to determine the effect on animals of food infested with mites, rats that were fed for 40 days on dough made from flour severely infested with *T. farinae* lost considerably in weight as compared with the controls and many of their internal organs became atrophied. In similar experiments with mice, however, there was a marked increase in weight in all the experimental animals due to pathological changes in the tissues. The author concludes from these preliminary tests that the animals are affected not by the mites themselves, but by the micro-organisms that accompany their development.

MEESER (C. C. V.). **Preliminary Notes on Simuliidae (Diptera) of Southern Rhodesia.**—*Proc. Rhod. sci. Ass.* **39** pp. 28–38, 3 pls., 4 refs. Salisbury, S. Rhod., 1942.

This paper consists of a list of 16 species of *Simulium* recorded from Southern Rhodesia (all except one having been taken there in 1940 or 1941), with data

on their distribution within the colony, and their breeding places. Brief notes are also given on the life-history of Simuliids in general, methods of collecting, rearing and preserving them, their relation to *Onchocerca volvulus* (which occurs, but has not been studied, in Southern Rhodesia) and their seasonal prevalence. Larvae were first found in considerable numbers at the end of the rains, and from this time onwards, formed big, black masses on rocks, etc. ; pupae became numerous at the end of April and were most abundant between May and August. In December 1941, females of *S. elgonensis*, Gibbins, were observed to enter the water to a depth of an inch and deposit eggs on a submerged rock, returning several times to add more eggs to the mass already laid. The process lasted 15–20 mins. Large numbers of *S. bovis*, De Meillon, were found by A. Cuthbertson attacking both Europeans and Africans ; adults of the other species were not observed to feed.

Jack (R. W.). **The Life Economy of a Tsetse Fly.**—*Proc. Rhod. sci. Ass.* **39** pp. 43–60. Salisbury, S. Rhod., 1942.

This paper was written to bring together the results of the research work of various investigators on the bionomics of the tsetse fly in such a way as to present a picture of its life-history as a whole, exemplified mainly by *Glossina morsitans*, Westw., which has been the particular subject of study in Southern Rhodesia [*cf. R.A.E.*, B **28** 22 ; **30** 115].

Jack (R. W.). **Report of the Division of Entomology** [Southern Rhodesia] **for the Year 1941.**—19 pp. typescript. Salisbury, S. Rhod., 1942.

More than a third of this report deals with work against *Glossina* spp [*cf. R.A.E.*, B **30** 54] and is composed largely of surveys of the situation in individual districts. In the northern districts, activities [directed against *G. morsitans*, Westw.] continued in areas recently included in the operations. An intensive effort is being made to render the whole of the Urungwe Native Reserve safe for cattle in the immediate future. Numbers of native cattle have continued to increase in all areas previously cleared [**30** 8].

On the eastern border (Melsetter District), there was an increase in the number of cases of trypanosomiasis of cattle and in the area over which they occurred. Further extensive clearing operations were carried out in the Inyamadzi valley, the principal channel through which *G. pallidipes*, Aust., and *G. brevipalpis*, Newst., enter Southern Rhodesia [**28** 50], and the old clearings were maintained. The total number of flies caught in or near the clearing was 35, comprising 10 males and 4 females of *G. brevipalpis* and 11 males and 10 females of *G. pallidipes*. Of these, 10 individuals of *G. brevipalpis* and 12 of *G. pallidipes* were taken in Southern Rhodesia. The steady spread of *G. morsitans* up the Sabi Valley in Portuguese East Africa towards the border of the lower Melsetter District was confirmed [**30** 55], one individual being caught within a mile of the border.

Papers noticed by Title only.

Robinson (G. G.). **The Mechanism of Insemination in the Argasid Tick,** *Ornithodorus moubata* **Murray.**—*Parasitology* **34** no. 2 pp. 195–198, 1 fig., 11 refs. London, 1942.

Jack (R. W.). **Ticks infesting domestic Animals in Southern Rhodesia.**—*Rhod. agric. J.* **39** nos. 2–3 pp. 95–109, 202–218, 1 diagr., 28 figs., 17 refs. Salisbury, S. Rhod., 1942. [Revision : *cf. R.A.E.*, B **16** 226 ; **25** 152.]

Ward (H. L.). **A Note on the Occurrence of a Syrphid Larva** [*Eristalis tenax*, L.] **as an accidental Parasite of Man** [in Indiana]. (Abstract.)—*Proc. Ind. Acad. Sci.* **49** (1939) pp. 199–200. Indianapolis, Ind., 1940. [Recd. December 1942.] [*Cf. R.A.E.*, B **30** 158.]

Ullyett (G. C.) & De Vries (A. H.). **Observations on the natural Control of Sheep Blowflies in South Africa. Part I. Predatory Wasps of the Genus** *Bembix*, **Fabr.**—*Sci. Bull. Dep. Agric. For. S. Afr.* no. 224, 23 pp., 8 figs., 9 refs. Pretoria, 1940. [Recd. December 1942.]

The chief contents of this bulletin have been noticed from a shorter account [*R.A.E.*, B **30** 157]. The data presented are based mainly on observations made on *Bembix olivata*, Dahlb., and *B. capensis*, Lep., which, with *B. melanopa*, Handl., and *B. capicola*, Handl., are the most abundant and widely distributed species known to prey on sheep blowflies in South Africa. The life-cycle from egg to adult occupies about one month. Natural enemies are few and unimportant; no true parasites or predators are known. Sarcophagids of the genus *Craticulina* seek entrance to the burrows, and if able to penetrate, deposit their larvae in the nests, where they consume the flies that the wasps bring for their young. However, they are not likely to have any serious effect on the population of *Bembix*, as the burrows of the latter are nearly always sealed, and if access is obtained and larvae deposited, enough food is usually brought for the *Bembix* larvae to develop as well as the Sarcophagids.

Vargas (L.). *Simulium fairchildi* **Vargas, 1942 n. n., de Panamá: Dipt. Simuliidae.**—*Medicina* **22** no. 420 pp. 458–459, 3 refs. Mexico, D.F., 1942.

In a paper already noticed [*R.A.E.*, B **29** 136], Fairchild described the male, female and pupa of a Simuliid from Panama that he considered to be *Simulium haematopotum*, Mall., though he pointed out that the genitalia of the female differed from that of this species as described by Dyar & Shannon [**15** 128]. Fairchild's species also differed from *S. pseudohaematopotum*, Hoffm. [**19** 113] in this character, and from both in having a tooth on the tarsal claw. The author confirms the differences on the basis of examination of examples of *S. haematopotum* from Mexico and considers that Fairchild described a new species, for which he proposes the name *S. fairchildi*.

Philip (C. B.). **Tularaemia in Alaska.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 71–73, 8 refs. Berkeley, Calif. [? 1942.]

Records are given of the isolation of *Bacterium tularense* from ticks (*Haemaphysalis leporis-palustris*, Pack.), taken on showshoe hares near Fairbanks, Alaska, in 1937 [*R.A.E.*, B **26** 160] and again in 1939, and of a possible case of tularaemia in man that was contracted 175 miles further north, well within the Arctic circle, in 1938, but was not confirmed by agglutination test. As it has been suggested that tularaemia is at least partly responsible for the cyclical fluctuations that occur in hare populations in the extreme north of America, certain epidemiological considerations are reviewed, and it is thought possible that ticks might act as a reservoir, and an epizootic be brought about under favourable conditions through the agency of mosquitos [*cf.* **21** 23; **27** 95, 138], Simuliids or Tabanids, all of which are abundant and have been shown to be capable of mechanical transfer.

Davis (G. E.). **The Rocky Mountain Spotted Fever Rickettsia in the Tick Genus** *Ornithodoros*.—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 577–579, 3 refs. Berkeley, Calif. [? 1942.]

An account is given of experiments in which Rocky Mountain spotted fever was transmitted to healthy guineapigs by nymphs and adults of each sex of *Ornithodoros parkeri*, Cooley, that had fed in earlier nymphal instars on infected ones [*R.A.E.*, B **30** 90]. Another guineapig was infected by injection of eggs laid by an infected female. Similar tests with *O. turicata*, Dugès, gave

negative results, but this species could harbour the infection [*cf.* **25** 112; **31** 10]. The localities in which *O. parkeri* has been collected [**28** 28; *cf.* also **30** 89] all lie within the region in which Rocky Mountain spotted fever is endemic and in which *Dermacentor andersoni*, Stiles, transmits it to man and *Haemaphysalis leporis-palustris*, Pack., among animals, and *O. parkeri* infests susceptible hosts of these ticks. These facts and its ability to transmit the infection experimentally suggest that it may help to maintain it in nature.

Philip (C. B.). **Rocky Mountain Spotted Fever: known and potential Tick Vectors in the United States.**—*Proc. 6th Pacif. Sci. Congr. 1939* **5** pp. 581–584, 11 refs. Berkeley, Calif. [? 1942.]

In view of the fact that the area of the United States in which Rocky Mountain spotted fever is known to be endemic has recently been vastly extended to include all the States except Kansas, Wisconsin, Michigan, Maine, New Hampshire, Vermont, Connecticut and Rhode Island, a summary is given of present knowledge on the known tick vectors (*Dermacentor andersoni*, Stiles, *D. variabilis*, Say, and *Haemaphysalis leporis-palustris*, Pack.) and the species that transmit the disease experimentally and are thought to be potential vectors in nature (*Amblyomma americanum*, L., *A. cayennense*, F., *D. occidentalis*, Marx, *Rhipicephalus sanguineus*, Latr., *D. parumapertus*, Neum., and *Ornithodoros parkeri*, Cooley).

Patiño-Camargo (L.). **Nuevas observaciones sobre un tercer foco de fiebre petequial (maculosa) en el hemisferio americano.** [New Observations on a third Focus of Spotted Fever in the American Hemisphere.]—*Bol. Ofic. sanit. pan-amer.* **20** no. 11 pp. 1112–1124, 1 map, 5 refs. Washington, D. C., 1941. (With a Summary in English.) [Recd. 1943.]

Nuevas observaciones sobre un tercer foco de fiebre petequial en el hemisferio americano.—*Rev. Fac. Med. Bogotá* **10** no. 5 pp. 359–376, 2 maps, 5 refs. Bogotá, 1941. [Recd. 1943.]

It is reported in these two papers, which are practically identical, that further cases of a tick-borne rickettsial disease occurred in 1940 and 1941 in Colombia, somewhat to the north-west of the focus discovered at Tobia in 1935 [*R.A.E.*, B **26** 41]. The position of the outbreaks and nature of the country are described. Protection tests [? against Rocky Mountain spotted fever] carried out in Montana with the sera of 15 persons who had been exposed to infection in 1940 and most of whom had recently suffered from mild illness gave 4 positive, 8 partial or uncertain and 3 negative reactions. Four strains of rickettsiae were isolated in guineapigs, the first and second from the blood of fatal cases, the third from an emulsion of one engorged nymph of *Amblyomma cayennense*, F., and three engorged larvae, apparently of the same species, taken from the dead body of the second case, and the fourth from four individuals of *A. cayennense*, which were taken on a mule belonging to a family among whom deaths from the disease had occurred, and which transmitted the infection by biting. The boy from whom the first strain was isolated was harbouring *Pediculus* [*humanus*] *capitis*, DeG., and numerous larvae of ticks, apparently *Amblyomma*. The first and third strains are being maintained by passage through guineapigs, rabbits and monkeys and in ticks, and were sent to Montana in examples of *Ornithodoros rudis*, Karsch (*venezuelensis*, Brumpt) that had engorged on guineapigs. The animals that have been found to be susceptible to infection are guineapigs, rabbits, *Macaca mulatta* (*Macacus rhesus*) and a native monkey, *Cebus fatuellus*. The disease having been recognised as a rickettsiasis of the spotted fever group, of which the other examples known in America are Rocky Mountain spotted fever and Brazilian spotted fever (exanthematic typhus), which occurs in Sào Paulo [*cf.* also **27** 35, 36], vectors were sought among ticks. The species infected experimentally

were *A. cayennense*, *O. rudis* and *Dermacentor nitens*, Neum., which are common in Colombia, and *D. andersoni*, Stiles, *O. parkeri*, Cooley, and *O. turicata*, Dugès, which do not occur there, and the experimentally acquired infection was transmitted by the feeding of the two species of *Dermacentor* and by inoculation of suspensions of *O. rudis* and *O. parkeri* 132 and 125 days, respectively, after the infective feed. The strains from the two human cases and from the ticks on one of them conferred immunity against each other.

ANIGSTEIN (L.) & BADER (M. N.). **New epidemiological Aspect of Spotted Fever in the Gulf Coast of Texas.**—*Science* **96** no. 2494 pp. 357–358. Lancaster, Pa., 1942.

An alarming increase in the incidence of typhus in Texas in 1942 was accentuated by a localised outbreak of spotted fever, which attacked four children in a wooded area of the Gulf Coast, two of whom died. Rickettsiae, coccoid in type, were found in various organs of the patients and of guineapigs inoculated with material from them. Two strains of the infective agent were established in guineapigs inoculated with material from these patients, in which they caused a high fever and occasionally a scrotal reaction, but a very low rate of mortality. The guineapigs that survived were found to be immune from a strain of spotted fever from Montana, but susceptible to strains of flea- and louse-borne typhus. The locality of the Texas outbreak was found to be heavily infested with the tick, *Amblyomma americanum*, L., and two examples were collected from the family of the victims. A further survey three months later showed that the several thousand ticks collected were exclusively *A. americanum*, which suggests that this tick is the vector of Gulf Coast spotted fever. It has been shown experimentally to transmit Rocky Mountain spotted fever, and other species of *Amblyomma* are known to be vectors of spotted fever in Colombia [see preceding abstract] and Brazil [*cf. R.A.E.*, B **26** 154, 155; **27** 35, 36]. The spotted fever of the Gulf Coast would, therefore, seem to be more closely related epidemiologically to that of South America than to that of the Rocky Mountains.

VIOLLE (H.) & JOYEUX (C.). **Présence d'un virus à rickettsias chez des lapins sauvages.**—*Arch. Inst. Pasteur Tunis* **30** no. 1–2 pp. 23–25, 9 refs. Tunis, 1941. [Recd. 1943.]

It has been shown in the laboratory that Marseilles fever can develop and persist in rabbits [*cf. R.A.E.*, B **20** 204]. In July 1940, two males and five females of *Rhipicephalus sanguineus*, Latr., and 56 larvae, all or most of which were of the same species, were removed from five wild rabbits taken at Cadarache, Bouches-du-Rhône. An infective agent, not definitely identified, but thought to be that of Marseilles fever, was isolated from the crushed bodies of the ticks and also from pooled blood of the rabbits, which were given mixed with food to rats that later showed a slight febrile reaction. After a passage in guineapigs, followed by a second passage in rats, rickettsiae were found in each case in the cells of the peritoneal exudate of the latter. Similar experiments with the brains of the rabbits gave negative results.

ANDERSON (C.), BERGE (C.), FAUCONNIER (H.) & RUNACHER (A.). **Étude d'un foyer de fièvre récurrente hispano-africaine dans la région de Bizerte-Ferryville-Mateur.**—*Arch. Inst. Pasteur Tunis* **30** no. 1–2 pp. 118–128, 1 map, 38 refs. Tunis, 1941. [Recd. 1943.]

In the summer of 1940, five cases of relapsing fever were found in two months within some 25 miles of one another in the neighbourhood of Bizerta, Tunisia,

where the first case was reported in 1931 [*R.A.E.*, B **19** 90] and the disease had not been recorded after 1933. None of the persons concerned was infested with lice or had been in contact with the others. A study of the effects on laboratory animals of the spirochaetes from two of the cases showed them to belong to the *Spirochaeta hispanica* group. The strains conferred immunity against reinoculation with the same strain 15 days and one month after recovery, but they did not immunise against each other or against an earlier Tunisian strain of *S. hispanica* or *S. duttoni*, nor did these immunise against the new strains [*cf.* **20** 247]; serological studies confirmed that lysis occurs only when spirochaetes of a given strain are exposed to the serum of animals recovered from infection with the same strain, and cannot, therefore, be put to any very practical use. An extensive search of burrows revealed the presence of individuals of *Ornithodoros erraticus*, Lucas. Great importance is attached to this, although the ticks were not infected, as natural infection in this species has been demonstrated elsewhere in Tunisia [**21** 244; **23** 261].

MACKENZIE (M. D.). **Some practical Considerations in the Control of Louse-borne Typhus Fever in Great Britain in the Light of Experience in Russia, Poland, Rumania and China.**—*Proc. R. Soc. Med.* **35** no. 2 pp. 141–156, 1 fldg. map, 4 graphs. London, 1941. (With Summaries in French, Spanish and Portuguese.) [Recd. 1943.]

The conditions that predispose a population to an epidemic of the form of typhus that is transmitted by lice [*Pediculus humanus*, L.] are discussed with particular reference to under-nourishment and widespread movement of large numbers of people, which are considered much more important than overcrowding. Louse-borne typhus is essentially a disease of cold countries, but may occur in tropical latitudes at very great elevations in winter. Where it is endemic, cases begin to appear in late November, are most numerous in March or April, and continue until the end of June or July. Epidemics may break out at any time. The manner in which the disease is carried over in endemic areas between outbreaks, immunity in populations in endemic areas, variations in virulence, and the duration of the incubation period are also discussed, and information is given on the clinical aspects of the disease and differential diagnosis. The administrative steps taken in dealing with widespread epidemics in Russia, Poland and China are outlined, although they are not likely to be applicable in Great Britain. With regard to control in this country, great stress is laid on the danger to which persons engaged in work with typhus patients are exposed, particularly those searching for cases and those working in the admission block of a hospital [*cf. R.A.E.*, B **30** 180], and it is emphasised that young persons should be employed, all hair cut very short and protective clothing worn and changed every 2 or 3 hours. A bag for the protection of persons having to sleep in places infested with lice is described. In view of the difficulty of tracing contacts, since a man harbouring infected lice can spread the disease from the day he acquired it, usually some 17 days before it can be recognised, much importance is attached to the reduction of lice among the population as a whole. The mechanical transfer of the louse is considered the commonest method of infection. The utmost care must be taken to see that disinfestation of a patient, known contacts, premises, ambulance and staff is complete. A special ambulance must be reserved for typhus cases, and it should be so designed that it can be completely cleaned and affords no harbourage to insects. The patient should be entirely enveloped in a long sheet before being taken to the ambulance. A second disinfestation a week after admission to hospital is recommended in case any eggs escaped destruction. Hydrocyanic acid gas is the most satisfactory agent for the disinfestation of premises and furniture.

NAUCK (E. G.) & WEYER (F.). **Erfahrungen bei der Zucht von Kleiderläusen und der künstlichen Infektion von Läusen mit Fleckfieber.** [Experience gained in Breeding *Pediculus humanus* and in its artificial Infection with Typhus.]—*Zbl. Bakt.* (I. Orig.) **147** pt. 6 pp. 353–364, 1 pl., 4 refs. Jena, 1941. [Recd. 1943.]

Notes are given on the technique found satisfactory at a typhus research institute established at Warsaw in 1940 for breeding lice [*Pediculus humanus*, L.] and infecting them with *Rickettsia prowazeki*. Newly hatched larvae should be fed on the bare arm for one or two days before being placed in the boxes in which they are usually kept. Gauze with a fine mesh must be used to enclose the small larvae, but after the first moult, which usually occurs after about 6 days, a coarser mesh is required since the lice are not able to take sufficient blood through very fine gauze. The lice should be examined periodically to see whether they are obtaining sufficient food, and if not, valuable material may be saved by direct feeding on the skin. Dead lice should be removed as quickly as possible, as bacteria develop rapidly in the hind gut, and may infect healthy individuals. Bacterial infections of living lice are rare, however, and easily recognisable, but infections by rickettsiae are difficult to recognise and avoid. Special precautions to obtain and maintain stocks of lice free from infection are described. Unless lice have been bred from such a stock, they are likely to be infected with *R. pediculi*, and newly hatched larvae may become infected with *R. pediculi* or *R. rocha-limae* from the excreta of older lice. The skin of the person on whom the lice feed is another source of infection. It can be cleansed by rubbing with alcohol, which must be completely evaporated before the lice are placed on it. The blood-meal itself may be infective. Volhynian [trench] fever was present in Warsaw, and its causal agent, *R. quintana*, with which *R. wolhynica* and probably *R. weigli* are identical, remains in the blood for many months, is acquired by lice and multiplies in them. Samples of excreta provide the best means for detecting rickettsial and bacterial infection in lice.

Lice can best be infected experimentally with *R. prowazeki* by feeding on typhus cases during the first week of the disease, when the numbers of rickettsiae in the blood are usually highest, or by rectal injection of a suspension of the brain of infected guineapigs or a suspension of the stomach of infected lice. The first two methods give low percentages of infection, but the third gives almost 100 per cent. positive results. The best method, therefore, of obtaining an infected louse population is to inject infected guineapig brain into lice and the stomachs of the resulting positive individuals into further lice. The presence of infection can be shown by examination of excreta, but not the species of rickettsia concerned. *R. prowazeki* can be recognised by inoculation into guineapigs, since it is the only rickettsia found in eastern Europe that is pathogenic to them, or by histological examination of the stomach tissue for intracellular rickettsiae. The various techniques involved are described. Red discoloration of lice is not a sure sign of infection by *R. prowazeki*.

NAUCK (E. G.) & ZUMPT (F.). **Versuche zur Uebertragung des epidemischen Fleckfiebers durch die Wanzen** *Cimex lectularius* **L. und** *Triatoma rubrofasciata* **De Geer.** [Experiments on the Transmission of epidemic Typhus by the Bugs, *C. lectularius* and *T. rubrofasciata*.]—*Zbl. Bakt.* (I. Orig.) **147** pt. 6 pp. 376–381, 3 refs. Jena, 1941. [Recd. 1943.]

The authors concluded from previous experiments that *Cimex lectularius*, L., cannot transmit murine typhus [*R.A.E.*, B **29** 155] and carried out further investigations in Warsaw in 1940, to ascertain whether *C. lectularius* and a South American bug, *Triatoma rubrofasciata*, DeG., can transmit *Rickettsia prowazeki*, the causal agent of epidemic typhus. Suspensions of the brains of

infected guineapigs or of the intestines of infected lice [*Pediculus humanus*, L.] were injected into the body-cavity of the bugs, and into the hind gut of *Triatoma*, and bugs were also caused to feed on infected guineapigs or man. In the experiments with *Cimex*, *R. prowazeki* remained infective for 26 days after injection into the body-cavity, but suspensions of bugs that had fed on infected guineapigs and the feeding of bugs infected by either method failed to infect healthy guineapigs. Similar experiments with *Triatoma* proved negative or doubtful. Neither bug acquired infection from human cases, but the latter were already at so late a stage that even *P. humanus* would have failed to become infected. Rickettsiae were not observed in the excreta of either bug. It is concluded that no increase of *R. prowazeki* occurs in the bugs, so that they cannot be used for the production of vaccine, and that they are unlikely to transmit typhus to man.

Sherrard (G. C.). **Five Fumigants for Disinfestation of Bedding and Clothing : a comparative Study of insecticidal Properties.**—*Publ. Hlth Rep.* **57** no. 20 pp. 753–759, 3 refs. Washington, D.C., 1942.

As the concentration of military and civilian populations in time of war favours the spread of diseases transmitted by vermin and the extensive fumigation of fabrics and clothing brought into the United States from infested territory may become necessary, comparative tests were made of the properties of hydrocyanic acid gas, chloropicrin, methyl bromide, a mixture of 1 part ethylene oxide and 9 parts carbon dioxide and a mixture of 3 parts ethylene dichloride and 1 part carbon tetrachloride, when used for the control of insects in clothing and bedding. The fumigation period was four hours in all tests. The insects used were bed-bugs (*Cimex lectularius*, L.) that had passed the third instar and adult cockroaches (*Blattella germanica*, L.). Tables show for both species the minimum lethal concentration of each fumigant and the concentration required to give complete kill at stated temperatures, at atmospheric pressure when the insects were unprotected or protected by 32 layers of blanket material and also in a 25-in. vacuum when they were protected. The minimum lethal concentration of each fumigant for rats is also shown as an indication of its toxicity to man. The relative toxicity of the fumigants to the various test animals, their power to penetrate fabrics, which was related to their molecular weight, their toxicity to insects within the four-hour period and delayed action on rats, the ease with which they can be detected by the senses (on which their safe use often depends), their effect on fabrics, the effect of temperature on their toxicity and the methods of using them are discussed.

It is concluded that the suitability of one or other fumigant depends on circumstances, as none was superior to the others under all conditions or in all respects. Hydrocyanic acid and chloropicrin were toxic at the lowest concentrations and are considered the most suitable for use on textiles. The latter penetrates fabric well, is non-explosive and easily perceptible in sublethal concentrations, but prolonged ventilation is necessary after it has been used, as it clings to fabrics, and unless it is used in an isolated building, its irritating properties for animal tissue necessitate an exhaust extending above surrounding buildings. A satisfactory kill of eggs of *C. lectularius* was obtained with a concentration of 12 oz. per 1,000 cu. ft. It is thought promising for the large-scale fumigation of clothing against lice [*Pediculus humanus*, L.] under war conditions ; the destruction of lice and their eggs by exposing them to a concentration of 4 cc. per cu. ft. for 30 mins. has been reported [*R.A.E.*, B **6** 189]. Methyl bromide was very toxic to the bugs and cockroaches, is non-explosive and presents no fire hazard, but has a delayed toxic effect in low concentrations and is not readily detected by the senses of smell and taste, and on this account is very dangerous. The mixture of ethylene oxide and carbon dioxide was effective when the insects were exposed to the full concentration but deficient in

penetrating qualities. A small percentage of both insects proved extremely resistant to it, while a small percentage of bed-bugs was quite susceptible. The mixture of ethylene dichloride and carbon tetrachloride appeared more toxic than the other mixture to the cockroach, and it was the more effective at temperatures below 65°F. High concentrations of both are needed to give satisfactory kill and they may have a cumulative toxic effect and are not easily detected. No new data on the value of hydrocyanic acid gas were obtained. It did not penetrate fabrics so readily as chloropicrin or methyl bromide at atmospheric pressure, the absence of warning qualities in lethal concentrations render it dangerous, and tests other than those described indicated that the residue remaining in fabrics in much greater than was formerly believed.

Roy (D. N.) & Ghosh (S. M.). **A new active Constituent of Pyrethrum Flower.**—*Nature* **150** no. 3796 p. 153, 1 graph, 2 refs. London, 1942.

The results of tests of the toxicity to adults of *Musca domestica vicina*, Macq., of pyrethrum extracts diluted with kerosene are shown in a graph. A proprietary extract and extracts prepared from samples of *Chrysanthemum cinerariaefolium* with pyrethrin contents of about 0·6 and 0·7 per cent. were all much more toxic at dilutions equivalent to less than 1 mg. pyrethrins per cc. than was an extract prepared from a sample of *C. roseum* with a pyrethrin content of 2·47 per cent. at dilutions equivalent to 2–2·4 mg. per cc. It is concluded that pyrethrum contains some toxic principle other than pyrethrins I and II, which operates on insects in the same way as these, and exists in larger quantities in samples of pyrethrum rich in pyrethrins than in others. Like pyrethrin, this principle is soluble in kerosene. This work confirms the finding [*R.A.E.*, B **29** 149] that a kerosene extract prepared from the residue left after extracting pyrethrins I and II from a sample of pyrethrum flowers [with petroleum ether] is still active.

Stewart (M. A.) & Roessler (E. B.). **The seasonal Distribution of Myiasis-producing Diptera.**—*J. econ. Ent.* **35** no. 3 pp. 408–411, 1 fig. Menasha, Wis., 1942.

To obtain data on the seasonal distribution of blowflies that infest domestic animals in the southern Sacramento Valley, California, 11 cone-type traps baited with lamb's liver and sodium sulphide were operated in slightly different ecological situations between 26th November 1935 and 17th December 1936. The catches were collected at intervals of 3–7 days, and representative samples identified. Members of the genus *Cochliomyia* were identified to species, but those of the genus *Lucilia* were not, on account of their similar behaviour with regard to myiasis. The only species of *Phormia* taken was *P. regina*, Mg. As the differences between the catches at the various traps were not statistically significant, the population densities are expressed in terms of the average number of *Lucilia*, *P. regina* and *C. macellaria*, F., per trap per day. There was no significant correlation between populations and temperature or saturation deficiency, except in the case of *C. macellaria*, the population of which was significantly correlated with saturation deficiency, though this did not necessarily imply causal effect. *P. regina* was most abundant between the first week of April and the first week of July, *Lucilia* between mid-April and the first week in July, with a second peak in October, and *C. macellaria* between the first week in August and mid-October. The highest populations, regardless of species, occurred between March and July. The results indicated that *P. regina* is the most important of the flies responsible for myiasis of animals in the locality because it is more abundant than the others over a considerable period. *C. macellaria* becomes the most important from August to October on account of its greater abundance and higher efficiency as a wound invader.

Species of *Lucilia* become the most important in November because they are the most abundant at that time. *C. hominivorax*, Coq. (*americana*, Cush. & Patt.), which was taken in very small numbers between the beginning of September and the beginning of December, assumes importance only in exceptional years such as 1940, when it was abundant following two unusually mild winters.

Lindquist (A. W.) & Deonier (C. C.). **Flight and Oviposition Habits of the Clear Lake Gnat.**—*J. econ. Ent.* **35** no. 3 pp. 411–415, 2 figs., 3 refs. Menasha, Wis., 1942.

Dense swarms of the Clear Lake gnat, which is now considered to be *Chaoborus astictopus*, Dyar & Shann. [*cf. R.A.E.*, B **25** 265], cause much annoyance near Clear Lake, California, from April or May to October, particularly round lights. One trap with lamps totalling 900 watts caught 88½ lb. of the insects (about 88 million) in 2 hours on one evening, and catches of 10–30 lb. are common. The adults, which were shown in tests to live 24–120 hours, the preoviposition period usually occupying 36–48 hours or more, emerge at night and disperse over an area extending up to 6 miles or more from the shore. They rest by day, but large swarms, consisting principally of paired females, approach the lake at sunset and fly along the shore line for 15–30 minutes and over the lake, unless conditions are too stormy or cold for oviposition, when they remain on the shore and live for several days, so that dense concentrations occur. Wind and low temperatures decrease activity. Air temperatures of 42°F. have been known to kill emerging adults. Traps some distance from the shore caught 90–98 per cent. males, whereas 50–90 per cent. of the gnats trapped at the water's edge were females, nearly all of which contained mature eggs. When conditions are favourable for oviposition, the instinct to fly over the lake is stronger than attraction to light.

After heavy oviposition, the water is covered with a sheet of white eggs, which have turned brown by morning and become concentrated in well-defined drifts, half to one mile from the shore, and occasionally occupying 200 acres. The eggs usually float towards the shore in the course of the morning, most of them accumulating at the shore line at concentrations of as much as 10 million to the square foot. They can then be destroyed by burning petrol on the surface of the water, but this must be done before they sink, which they do as a result of the wave action that generally occurs in the afternoon. When the wind rises before the drifts have reached the shore, the eggs are sunk by white-capped waves, but can float on smooth rolling waves. They did not sink when protected from waves. Some 75 per cent. of the visible eggs hatch within a few feet of the shore, and the young larvae are transported by current and undertows out into the lake, over the bottom of which they are very uniformly scattered. Larvae are approximately equally abundant in smaller lakes in the neighbourhood. It is believed that the heavy breeding in Clear Lake may be attributed to its large area, high temperatures (45–78°F. at the bottom) and abundant plankton.

Dissected females contained 256–337 ova. Experiments showed that the lake water is favourable for oviposition and hatching whereas tap water is not, and that eggs on the surface hatch more quickly than submerged ones. Eggs subjected to a temperature of 44–51°F. for 126 hours did not hatch, but others exposed for 42 hours were not affected.

Hartzell (A.) & Scudder (H. I.). **Histological Effects of Pyrethrum and an Activator on the central Nervous System of the Housefly.**—*J. econ. Ent.* **35** no. 3 pp. 428–433, 16 figs., 9 refs. Menasha, Wis., 1942.

The following is substantially the authors' summary and conclusions. Pyrethrum and its activator, isobutyl undecylene amide, tested as fly-sprays

in an oil base, each show characteristic effects on the central nervous system and associated tissues of adults of *Musca domestica*, L. Pyrethrum has a widespread clumping effect on the chromatin of the nuclei, whereas the activator seems to cause a chromatolysis or dissolution of the chromatin. A combination of these two agents (as in Pyrin) shows a histological picture that is a summation of the effects of both. The interaction of these two types of nuclear destruction may be the true basis of "activation." It seems likely that a study of the progression of these effects can be made, perhaps even to include the nature of revival of knockdowns.

DEONIER (C. C.). **Insect Pests breeding in Vegetable Refuse in Arizona.**—*J. econ. Ent.* **35** no. 3 pp. 457–458. Menasha, Wis., 1942.

The improper disposal of vegetable refuse in the fruit and market-garden areas of Arizona has created a menace to public health. A survey in 1938 showed that large quantities of lettuce refuse piled on waste land constituted one of the main breeding places for *Musca domestica*, L., and smaller numbers of *Muscina stabulans*, Fall., and *M. assimilis*, Fall., also developed in them. Other insects, particularly *Drosophila* spp., bred in grapefruit peel dumps near canneries, and swarms of *Drosophila* migrated into the towns, where they were attracted to garbage pails and fruit stands and attacked exposed fruit inside houses.

GOMES (J. G.). **Subsídios à sistemática dos calcidídeos brasileiros.** [Contributions to the Classification of Brazilian Chalcididae.]—*Bol. Esc. nac. Agron.* 1941 no. 2 pp. 9–45, 4 pls., 2 figs., refs. Rio de Janeiro, 1942. (With a Summary in English.)

In the third part of this paper [*R.A.E.*, A **31** 118] the author erects the new genus *Comperia* for the Encyrtid, *Dicarnosis merceti*, Comp., two females of which were found in a building in the Federal District, Brazil, and which is probably an endophagous parasite of the oothecae of cockroaches. *C. merceti* var. *falsicornis*, n., is described from one of these females and from adults of both sexes thought to have been reared from oothecae of *Blattella germanica*, L., in the same locality.

TAUBER (O. E.) & GRIFFITHS jr. (J. T.). **Isolation of** *Staphylococcus albus* **from Hemolymph of the Roach,** *Blatta orientalis*.—*Proc. Soc. exp. Biol.* **51** no. 1 pp. 45–47, 4 refs. New York, N.Y., 1942.

A pathogenic bacterium, the characteristics of which are described, was isolated in pure culture from the haemolymph of *Blatta orientalis*, L., from Mississippi, and was identified as *Staphylococcus albus*. Infections were established in normal cockroaches by inoculating them with diseased haemolymph or with broth cultures. Death was preceded by a progressive paralysis.

HAMMON (W. McD.) & REEVES (W. C.). *Culex tarsalis* **Coq. a proven Vector of St. Louis Encephalitis.**—*Proc. Soc. exp. Biol.* **51** no. 1 pp. 142–143, 10 refs. New York, N.Y., 1942.

An account is given of two experiments carried out in 1942 in Texas in which laboratory reared females of *Culex tarsalis*, Coq., were infected with St. Louis encephalitis by feeding on cotton soaked with a blood-virus mixture and transmitted the virus to chickens on which they were subsequently fed. The virus of St. Louis encephalitis was isolated three times from *C. tarsalis* in the Yakima Valley in 1941 [*cf. R.A.E.*, B **29** 195], and the strain employed for the experiments was only 3 mouse-brain passages removed from one of these. In the first experiment, two mosquitos infected a chicken on the 8th day after

they had fed on the virus mixture and the virus was isolated from them on the 15th day. In the second, some members of a batch of 52 mosquitos fed on successive chickens after 4, 6, 8 and 10 days' incubation and infected all four of them. The 18 mosquitos that survived until the 10th day were killed and the virus was isolated from them.

C. coronator, D. & K., was also shown to be capable of transmitting the St. Louis virus to chickens. This latter species is potentially important in the lower Rio Grande valley, where antibodies to the St. Louis virus were found in the sera of man and domestic animals during an epidemic of encephalitis that occurred in 1941.

CAUSEY (O. R.), DEANE (L. M.), DEANE (M. P.) & SAMPAIO (M.). **Note clarifying the Status of *Anopheles albitarsis* and *Anopheles darlingi* (Diptera: Culicidae).**—*Proc. ent. Soc. Wash.* **44** no. 6 pp. 122–126, 6 figs., 5 refs. Washington, D.C., 1942.

The authors conclude from the examination and breeding out of several thousand batches of eggs laid by isolated Anophelines from various parts of Brazil, including some of the areas studied by F. M. Root [*R.A.E.*, B **14** 197], that the eggs described by him as those of *Anopheles darlingi*, Root, were immature, that the ones that he described for *A. albitarsis*, Arrib., were mature eggs of *A. darlingi*, and that he had no true *albitarsis* eggs. They also suggest that the egg he described for *A. tarsimaculatus*, Goeldi, may have been that of *A. oswaldoi*, Peryassú, which he considered synonymous with *tarsimaculatus*. Eggs obtained by the authors from 286 isolated females identified as *A. oswaldoi* conformed with Root's description. However, a similar type of egg has been obtained from a closely allied species in the same region. Root's descriptions and reproductions of his drawings of the eggs that he considered to be those of *A. albitarsis*, *A. darlingi* and *A. tarsimaculatus* are given and also descriptions of the eggs of *A. albitarsis* and *A. darlingi* from the authors' material and camera lucida drawings of them and of the egg of *A. oswaldoi*. Root's description of the morphology of the eggs of *A. darlingi* and an ambiguous phrase in his description of the male genitalia led Galvão, Lane & Corrêa to propose the variety *paulistensis* [**26** 55], which is synonymous with the typical *darlingi*.

MAZZOTTI (L.). **Los ornithodoros de Mexico y su relación con la fiebre recurrente.** [The Mexican Species of *Ornithodoros* and their Relation to Relapsing Fever.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 1 pp. 47–52, 13 refs. Mexico, D.F., 1942. (With a Summary in English.)

The author enumerates the localities in which *Ornithodoros turicata*, Dugès, *O. nicollei*, Mooser, *O. talaje*, Guér., and *O. coriaceus*, Koch, have been recorded in Mexico, those in which these ticks were taken by the author in 1939–42, and the results of tests to ascertain whether they were infected with the spirochaete, *Spirochaeta turicatae*, that causes relapsing fever in man in Mexico [*cf. R.A.E.*, B **28** 68], in which batches of each tick from various Mexican States were allowed to feed on mice or were injected into them. The mice were observed for 7 days, since the incubation period of *S. turicatae* is seldom longer in these animals. The only species found infected was *O. turicata* [*cf.* **28** 67], one of the infected batches of which came from a locality from which the spirochaete had not previously been recorded.

O. talaje transmits *S. venezuelensis* in South America and Panama [*cf.* **28** 68], but relapsing fever has not been observed in the regions in Mexico in which this tick is present. Relapsing fever is stated by Hoffmann [**18** 271] to occur in Veracruz, Campeche and Yucatan, but investigations by the authors and others are considered to show that *O. talaje* is absent from Yucatan.

Other species of *Ornithodoros* that are found in Mexico but are of no medical importance are *O. megnini*, Dugès [**28** 67], *O. coprophilus*, McIntosh [**29** 145] and *O. dyeri*, Cooley & Kohls [**30** 11].

VARGAS (L.). *Anopheles xelajuensis* **Romeo de León, 1938 en México.**—*Rev. Inst. Salub. Enferm. trop.* **3** no. 2 pp. 169–175, 4 figs., 1 ref. Mexico, D.F., 1942. (With a Summary in English.)

Anopheles xelajuensis, De León, was described [*cf. R.A.E.*, B **31** 21] from a single male taken among rocks in an oak wood in Guatemala. De León considered the species to be typical of high altitudes and stated that it probably breeds in tree-holes ; he found a second-instar larva in a hole in an oak. In April and May 1942, 3 males, 4 females, 7 larvae and 7 larval exuviae of this Anopheline were taken in two localities in the State of San Luis Potosí, Mexico, one of which was less than 650 ft. above sea-level. The larvae were found in a tree-hole. Descriptions are given of the male, female and larva, with diagnostic characters for the larva, and the species is referred, on the basis of the male terminalia, to the subgenus *Anopheles*.

VARGAS (L.) & MARTINEZ PALACIOS (A.). *Anopheles hectoris* **Mira, 1931.**—*Rev. Inst. Salub. Enferm. trop.* **3** no. 2 pp. 177–184, 5 figs., 8 refs. Mexico, D.F., 1942.

Descriptions are given of the egg, larva and adults of *Anopheles hectoris*, Giaquinto, and its distribution in Guatemala and Mexico is reviewed from the literature.

VARGAS (L.). **Notas sobre la terminalia de algunos simulidos de México.** *S.* (*E.*) *paynei* **n.n. Vargas, 1942.** [Notes on the Terminalia of some Mexican Simuliids.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 3 pp. 229–248, 4 pls., 57 refs. Mexico, D.F., 1942. (With a Summary in English.)

The author describes or quotes previous descriptions of the terminalia of both sexes of *Simulium callidum*, Dyar & Shannon, *S. haematopotum*, Mall., *S. metallicum*, Bellardi, *S. mexicanum*, Bellardi, *S. occidentale*, Tns. (*forbesi*, Mall.), *S. ochraceum*, Wlk. (*fulvum*, Coq.), *S. trivittatum*, Mall. (*distinctum*, Mall.), *S. virgatum virgatum*, Coq. (*hippovorum*, Mall.), *S. v. rubicundulum*, Knab, and *S. vittatum*, Zett., the male terminalia of *S. samboni*, Jenn., and the female terminalia of *S. alticolum*, Dyar & Shannon. He also figures the female terminalia of *S. exiguum*, Roub., and cites records of the occurrence in Mexico of *S. falculatum*, End. He considers *S. pseudohaematopotum*, Hoffmann, to be a synonym of *S. haematopotum* [*cf. R.A.E.*, B **31** 41] and erects the new name *S. paynei* for *S.* (*Hemicnetha*) *mexicanum*, End., nec *S.* (*Cnetha*) *mexicanum*, Bell.

ROZEBOOM (L. E.). **Subspecific Variations among neotropical** *Anopheles* **Mosquitoes, and their Importance in the Transmission of Malaria.**—*Amer. J. trop. Med.* **22** no. 3 pp. 235–246, 5 pls., 3 pp. refs. Baltimore, Md., 1942.

In view of the acquisition by the United States of defence bases in the Caribbean area, the evidence for the existence of differences within species of the Anophelines of tropical America, as now recognised, is reviewed from the literature. Both morphological and biological variations are considered, the former concerning chiefly the characters of the eggs and the latter the feeding habits and importance in the transmission of malaria of the species in different localities. It is concluded that present knowledge is hardly sufficient to enable definite inferences to be drawn from it. Lines for future work are suggested, including the establishment of a laboratory where all forms could be brought together and cross-breeding experiments made.

SMITH (G. E.). **The Keg Shelter as a Diurnal Resting Place of** *Anopheles quadrimaculatus*.—*Amer. J. trop. Med.* **22** no. 3 pp. 257–269, 5 figs., 6 refs. Baltimore, Md., 1942.

To determine the density of populations of *Anopheles quadrimaculatus*, Say, in the Tennessee Valley, it has been customary to collect adults resting by day in houses, barns and other outbuildings near impounded water, but as indices based on such collections are unsatisfactory, efforts were made to devise an improved method. Light-traps [*R.A.E.*, B **20** 241] with various coloured lights proved unsatisfactory, and collections from traps baited with man, domestic animals or rodents provided less information than those made in outbuildings. More mosquitos entered these traps when the door was left open and the trap unbaited than when the trap was baited and the door closed. As this indicated that the provision of a day-time resting place with conditions approximating to the optimum would give better results than the provision of food, shelters of various designs were tested. A small, empty keg, placed in a horizontal position on the ground near the shoreline of the breeding area, in a deeply shaded place protected from wind, was found to be very satisfactory, and had the advantages of uniformity and mobility. It was observed during 20 consecutive days' and nights' inspection of 24 kegs that the adults move from the light to darker places, usually woods or clumps of bushes, at daybreak, and penetrate further into the darkness as the light increases. Males and females, fed, unfed and gravid, enter the kegs at dawn and remain in them throughout the day. They leave them at dusk, and others do not enter until dawn the following day. Attempts to improve the effectiveness of the kegs by altering the microclimate by introducing baits failed, but kegs lined with black caught more mosquitos than others lined with white. Well-placed kegs provide the darkness, low temperature and high humidity required, without alteration. Concurrent increases or decreases in population were usually observed in kegs and barns in the same areas, but barns served principally as nocturnal feeding grounds, most of the mosquitos collected from them being freshly engorged females. The number of kegs required to catch an adequate sample of the mosquito population varies with the nature of the country, more being required where trees are all along the water's edge and the mosquito population is consequently scattered than where the woodland is in clumps. *A. punctipennis*, Say, a few individuals of *A. crucians*, Wied., and one of *A. walkeri*, Theo., were taken in the kegs in addition to *A. quadrimaculatus*.

HINMAN (E. H.), CROWELL (R. L.) & HURLBUT (H. S.). **Studies on Copper Arsenite, a new Anopheline Larvicide.**—*Amer. J. trop. Med.* **22** no. 3 pp. 271–281, 8 refs. Baltimore, Md., 1942.

In 1937, research was undertaken by the Tennessee Valley Authority to develop an arsenical that would be cheaper and more effective against Anopheline larvae than Paris green, as the cost of the latter represented two-thirds of the cost of dusting reservoirs by aeroplane [*R.A.E.*, B **26** 132, etc.]. Ten arsenites and also various compounds upon which arsenic trioxide had been absorbed were tested in the laboratory on larvae of *Anopheles quadrimaculatus*, Say.

Copper arsenite and calcium arsenite, particularly the former, showed promise, but the latter did not give consistent results in a field experiment. Applied from a hand duster in field trials in 1938, copper arsenite gave an average kill of 83 per cent. Two field trials with aeroplane distribution were therefore made in September 1938, and over 90 per cent. mortality was obtained. In 1939, 92 laboratory preparations of copper arsenite all showed definite superiority to Paris green, a plant that produced 3½ tons was constructed, and field tests with this material were made. It was applied from an aeroplane,

ordinarily at 1–1½ lb. per acre, between sunrise and 7 a.m., and was found to be at least as effective as Paris green in nearly all the tests except five early ones in which the bad results were attributed to physical properties. The exact nature of these was not discovered, but they were corrected by technical changes in the process of preparation. The total percentage reduction in Anopheline larvae effected in all the other tests was 77·6, and the corresponding reduction in 12 parallel tests with Paris green was 74·7. Laboratory studies on the influence of particle size indicated that fractions averaging 5 or 15 microns in diameter were more efficient than fractions averaging 25. Since the copper arsenite prepared for the tests was of uniformly fine particle size, it is believed that this may be partly responsible for its superiority over Paris green. About 23 per cent. of the Paris green theoretically applied and a much lower percentage of copper arsenite, sometimes only 5 per cent., was recoverable from the surface of the water. It is thought that if a means can be evolved of distributing copper arsenite so that a high percentage reaches the water, it will prove superior to Paris green in the field, and it should be possible to manufacture it much more cheaply as it contains less copper and no acetic acid.

In experiments carried out on the dilution of dusts, in view of the difficulty of applying very small quantities for experimental purposes, dilution with soapstone to as much as 1 : 19 did not reduce the efficiency of a given quantity of copper arsenite or Paris green, but a dilution of 1 : 39 gave less consistent results and one of 1 : 79 gave a noticeably smaller kill. Attempts to determine the minimum lethal dose of Paris green for fourth-instar larvae indicated that it is less than 0·0004 mg., but a satisfactory determination was not possible, as it would have entailed the application of less than 2 mg. of a dust diluted to 1 : 19. Copper arsenite was markedly more lethal to first-instar larvae than Paris green, to which they are much more resistant than other stages. It was found that an arsenite of a given metal of high arsenic content was a more efficient larvicide than one with a lower percentage of arsenic, even though the larvicides were so applied as to provide equivalent quantities of arsenic.

HOWARD jr. (R. S.) & ANDREWS (J.). **Studies on the Concentration and Distribution of Paris-green-Lime Mixtures applied as Anopheline Larvicides.**— *Amer. J. trop. Med.* **22** no. 3 pp. 283–293, 2 figs., 1 chart, 9 refs. Baltimore, Md., 1942.

An account is given of experiments made in 1940 with a view to improving the application of Paris green for the control of Anopheline larvae in Georgia, where the diversity of conditions makes aeroplane dusting impracticable. Preliminary tests with lime alone applied from a hand duster indicated that 2 lb. per acre would give satisfactory coverage, but that it was easier to make a uniform deposit with 3 or 4 lb. It is customary, whether a hand-operated or a power duster is being used, to regulate coverage by observing the dust-cloud, but studies with the hand duster showed that the Paris green, presumably on account of the greater density of its particles, settled more rapidly and nearer the duster than the lime with which it was mixed in various proportions, so that the whole of the visible dust-cloud did not deposit enough Paris green upon the water to kill Anopheline larvae. Further experiments indicated that when 3 or 5 lb. per acre of a 10 per cent. mixture are used, the range over which a lethal dose is deposited by the hand duster is not more than 150–200 ft. or about half the distance covered by the visible cloud. Similar tests with a power duster showed that the more rapid settling of the Paris green is delayed by higher initial velocity, but occurs when this is spent, and the extent of effective coverage from power dusters is also probably not more than half the distance covered by the visible cloud. The necessity for allowing for interference by trees was demonstrated. Methods of improving the efficiency of dusting from the ground, suggested as a result of these findings, are the use of a

diluent with a density and behaviour in aerial suspension comparable with those of Paris green, or the use of Paris green alone if equipment can be found that will apply uniformly 1 lb. or less per acre.

IRWIN (W. H.). **The Role of certain northern Michigan Bog Mats in Mosquito Production.**—*Ecology* **23** no. 4 pp. 466–477, 2 figs., 8 refs. Lancaster, Pa., 1942.

The following is based on the author's introduction and summary. Bog lakes in the Great Lakes region are characterised by marginal mats that vary in kind and differ in size from small fringes to conspicuous areas many acres in extent. These mats overgrow the open water and impound great quantities of water within and upon themselves in such a way as to provide apparently favourable breeding places for mosquitos. Investigations of the extent to which mosquitos breed in them were therefore carried out in northern Michigan in 1935–39. It was found that breeding did not occur in the water within the mats, since the interstices were too small to permit larval development. Mosquitos that bred upon the mats showed a definite seasonal succession. Gradual decrease in size of pools by drying was a regular event in spring and resulted in increasing concentration of mosquito larvae and aquatic predators, gradual reduction of feeding areas, increasing temperature and shrinking water supply. The result of drying was disappearance of pools and termination of mosquito production. The regular spring disappearance of most pools on a *Sphagnum* mat explained the almost complete absence throughout the summer of breeding mosquitos from such a mat. Mosquitos that bred on these mats did not appear to be influenced directly in any important way by variations of the chemical features of the impounded water. A water sampler and a strainer used in the investigation are described, and lists are given of the mosquitos taken as larvae and as adults, showing the months in which they occurred and the types of bog pools in which the larvae were found.

[YAGUZHINSKAYA (L. V.).] **Ягужинская (Л. В.) Présence d'une membrane péritrophique dans l'estomac de la femelle adulte d'***Anopheles maculipennis*. [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 601–603, 2 figs. Moscow, 1940. (With a Summary in French.) [Recd. 1943.]

In the course of investigations in Moscow on the physiology of digestion in mosquitos, a peritrophic membrane was discovered in adult females of *Anopheles maculipennis*, Mg. The function of this membrane, which is known to occur in mosquito larvae, is to protect the epithelium of the mid-gut from mechanical injury by particles of food, and its absence in insects that feed exclusively on fluids was considered normal. It has, however, been observed by Wigglesworth in *Glossina* [*cf. R.A.E.*, B **18** 173] and by Olsuf'ev in female Tabanids. In mosquitos, the membrane is formed in the midgut each time that the latter is filled with blood and on the completion of digestion it is evacuated with the excreta. It envelops the blood as a thin capsule, and in the early stages of digestion it is frequently open at the posterior end ; as digestion is completed, the membrane closes up. Apparently, a new membrane can be added to, or formed over, the old one, which partly degenerates in the process of digestion. Chemical reactions proved it to be composed of chitin. The membrane is absent in newly emerged females and in those that have digested the blood-meal and consequently have an empty stomach. It was not formed when the stomach was filled with saline or when the mosquitos had fed on water or sugar solution. Its absence in empty stomachs probably accounts for the fact that it had not been observed previously. It may have a bearing on the penetration of parasites into the wall of the intestine. It is suggested that the transmission of the causal agents of diseases by blood-sucking insects may depend partly on the character of the peritrophic membrane.

[Markovich (N. Ya.).] **Маркович (Н. Я.). Essais de lutte contre l'insecte ailé de l'*Anopheles maculipennis* au nord.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 604–608, 3 graphs. Moscow, 1940. [Recd. 1943.]

In the summer of 1939, experiments on the control of adults of *Anopheles maculipennis*, Mg., in buildings were carried out in a group of villages on a river in the Province of Archangel. The usual type of dwelling there consists of a high log house joined by a passage to a large cow-house over which is a hay loft some 16 ft. high, and adjoining separate closed or open sheds, some 23 ft. high. In summer, the inhabitants usually sleep in the passage and the loft. The mosquitos began to leave their hibernation quarters on 18th–19th May and to oviposit on 25th–28th May, and first-generation adults first emerged on 22nd June; females with a developed fat-body were abundant in early August. The mosquitos concentrated in the cow-houses, and hardly any were observed in the living rooms or passages. Owing to the height of the sheds and lofts, the numbers of mosquitos in them could not be estimated, but those caught constituted 2–16½ and 2–73 per cent., respectively, of the total catch. The mosquitos were collected by hand in the living rooms and passages, but the cow-houses were sprayed with a 3 per cent. solution of soft soap, with the addition in some cases of raw alcohol (2 per cent.), which considerably increased the effectiveness of the spray. In all, 18 applications were made between 7th June and 25th August at intervals of 5 or 6 days. The lofts and sheds were not treated. Examination of the cow-houses 2–3 hours after spraying showed that in most cases some of the mosquitos survived, and the proportion that did so increased as the cow-houses were larger and darker and had more recesses and corners. A comparison with neighbouring untreated villages, however, indicated that even partial treatment of infested buildings results in a reduction in the numbers of mosquitos and this was particularly evident during the period preceding the emergence of the first generation. Examination of the ampullae of the oviducts of active females showed that the numbers of older individuals taken were twice as great in untreated as in treated villages.

[Shlenova (M. F.).] **Шленова (М. Ф.). Quelques déductions pratiques de l'expérience de lutte contre les moustiques dans les exploitations de tourbe d'Ozérétzkoïe.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 609–614, 3 figs. Moscow, 1940. [Recd. 1943.]

In the course of an anti-malaria campaign in a peat-bog district in the Province of Moscow [*cf. R.A.E.*, B **29** 22], it was found that if dusting against the larvae of *Anopheles maculipennis*, Mg., is stopped too early in the autumn, there is a considerable increase in the numbers of the overwintering adults, which renders work in spring more difficult. Thus, in 1934 the larvicide was last applied on 15th September, after which the adults did not appear in any considerable numbers, but in 1935, the last application was on 13th August and many mosquitos emerged in autumn; three times as many adults emerged from hibernation in the spring of 1936 as in that of 1935. The systematic destruction in spring of females in cow-houses, which are their chief day-time shelters, considerably reduces the number that complete digestion and thus the number of eggs laid. The examination of breeding places near a village in which the adults were sytematically destroyed and near a control village showed that the numbers of larvae caught per dip within a radius of 1,100 yards averaged 1½ and 12½, respectively; no larvae were taken outside that radius round the treated village, whereas they were taken at distances of up to 2½ miles round the untreated one. In both cases the larvae became scarcer as the distance from the village increased.

Previous observations had shown that in this district men were seldom attacked in the open [*cf.* **23** 109; **26** 48], but mosquitos were very active at

night out of doors in the summer of 1936, when owing to unusually hot weather, most of the workmen slept in the open. Whereas in 1934–35, only 5–6 per cent. of the mosquitos caught in traps when entering the huts contained blood, in 1936, the percentage was 12·2 in mid-June, 51·7 during the last ten days of July and 19·5 in mid-August, this curve coinciding with the rise in temperature. Examination showed that the mosquitos caught entering buildings in the evening and the first half of the night chiefly consisted of unfed individuals, whereas those containing blood entered in the early morning before sunrise. This indicated that the mosquitos used the huts and cow-houses on hot days only as shelters in which to digest their blood meal. Of the engorged females trapped in 1936 when entering the huts, 59 per cent. contained human blood in June, 92·2 in July and 61·5 in August, and the corresponding percentages for those trapped in cow-houses were 6·8, 15 and 14·2. It appears, therefore, that there was no increase in the incidence of attack on cattle, and that the increased attack on man was due to a change in the habits of the population. It is concluded that *A. maculipennis* is primarily attracted to men at night, wherever they may be, and less by the conditions of temperature and humidity out of doors.

The effect of meteorological conditions on the distribution of mosquitos in day-time shelters was observed in cow-houses in April ; all the mosquitos occurred on the inner side of the roof of the hay-lofts, where the temperature was 13°C. [55·4°F.] and the relative humidity 67 per cent. In July, when the temperature and humidity in the lofts rose to 30·3°C. [86·48°F.] and 48 per cent., respectively, they were observed in the lower part of the cow-houses where the temperature and humidity were 22·7°C. [72·86°F.] and 59 per cent., and concentrated on the walls in dark corners.

[LEVIT (A. B.), LANGERMAN (V. N.) & ZAVOĬSKAYA (V. K.).] **Левит (А. Б.), Лангерман (В. Н.) и Завойская (В. К.). Sur la valeur de** *A. m. maculipennis* **et** *A. m. messeae* **dans l'épidémiologie du paludisme dans le rayon de Syzran de la région Kouibichev.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 615–617. Moscow, 1940. [Recd. 1943.]

Examination of eggs laid by females of *Anopheles maculipennis*, Mg., taken in three villages in the region of Suizran on the western bank of the middle Volga, showed that vars. *typicus* and *messeae*, Flni., were present in varying proportions. Precipitin tests showed that 1·1–3·9 per cent. of the females containing blood had fed on man and the rest on animals (chiefly cattle and sheep). Of the 146 females of *typicus* and 682 of *messeae* that were dissected, 2 and 4, respectively, contained oöcysts. It is concluded that these two varieties are about equally important as vectors of malaria in the region.

[PRENDEL (A. R.).] **Прендель (А. Р.). Essais de contrôle de certaines méthodes de désinsection des abris diurnes des moustiques.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 637–638. Moscow, 1940. [Recd. 1943.]

Insecticides that could be applied against mosquitos in their day-time shelters were tested in Odessa in large muslin cages containing 50–100 examples of *Anopheles maculipennis*, Mg., *Aëdes caspius*, Pall., and *Culex pipiens*, L. Mosquitos that fell to the ground were counted as dead since experience has shown that such individuals never survive. The easiest to prepare and apply, and the cheapest, were emulsions containing ½ per cent. soft soap and 1 per cent. formalin, or ½ per cent. hard soap and 2 per cent. crude alcohol, which gave complete mortality of the mosquitos and are recommended for treatment of cow-houses, etc., but produce too much humidity for use in dwelling houses. Higher concentrations (¾–3 per cent. soap) were less effective, as it was impossible to obtain a sufficiently fine dispersion. Other insecticides that gave

100 per cent. mortality included pyrethrum dust alone or mixed with an equal amount of wood ash, which is recommended for living rooms, a cheaper dust, prepared from pyrethrum residue, which required a higher rate of application, a dust of 15 per cent. anabasine sulphate, a spray prepared by steeping pyrethrum residue for 10 days in benzine, and one containing ½ per cent. soap and 0·1 per cent. anabasine sulphate.

[Bozhenko (V. P.).] **Боженко (В. П.). A propos de la possibilité d'un empoisonnement des animaux et des oiseaux-nageurs pendant l'application des suspensions du vert de Paris dans la lutte contre les larves des moustiques.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 640–642. Moscow, 1940. [Recd. 1943.]

The possibility of cattle and ducks being poisoned as a result of spraying against Anopheline larvae with water containing suspensions of Paris green in oil [*cf. R.A.E.*, B **28** 37, etc.] was studied in eastern Kazakstan in the summer of 1939. Plots of ground covered with vegetation were selected, and pools in them were sprayed at rates of application equivalent to about 9 oz. Paris green, 3½ pints kerosene or crude oil and 28 gals. water per acre. Calves six months old (at which age they are particularly susceptible to arsenic) were allowed to graze for 2–3 days on the plots after 1, 5, 8 or 10 applications of the spray.

Five applications in 12 days, in which a total of 2·7 lb. Paris green was released per acre, had no effect on the animals, but 8 applications in 23 days, in which 4·3 lb. was released, caused fatal poisoning. Ten applications in 25 days, however, had no evident effect. To render the treatment harmless, care should be taken not to apply the poison to grass more than 20 inches from the edge of the water, the poison should be evenly dispersed on the water, and shallow water covered with vegetation and visited by cattle should be treated not more than 5 times. These results were confirmed by field observations in other localities, in which cattle were not affected by grazing in areas that had been repeatedly sprayed and sprayed for the last time three days previously. Ducks released for three days in water treated five or ten times with a mixture of Paris green and crude oil were not affected. It appears that although oil increases the effectiveness of Paris green against Anopheline larvae, it coats the particles and thus renders the poison less toxic to warm-blooded animals. Sub-lethal doses of untreated Paris green caused acute diarrhoea in rabbits, but when it had been wetted with oil, the animals were not affected.

[Sergeeva (Z. D.).] **Сергеева (З. Д.). Larves d'*Anopheles* dans les exploitations de tourbe de BRSS.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 642–643. Moscow, 1940. [Recd. 1943.]

In view of the existing opinion that malaria is absent from the peat districts in the Republic of White Russia, a survey was carried out in July and August 1936 in a number of the more important peat-bogs in various districts to determine whether they offer favourable conditions for the breeding of Anophelines. The only Anopheline found was *Anopheles maculipennis*, Mg., and the findings of Beklemishev on the connection between the presence of the larvae and the type of aquatic vegetation [*R.A.E.*, B **23** 107] were confirmed.

The abundance of the larvae was estimated by taking samples in waters with as homogeneous a vegetation as possible, and the results, which are tabulated, showed that they were more numerous in the presence of Elodeids, amphibious plants (such as *Agrostis alba*) or a Lemnid plankton flora [*cf.* **22** 75, 76]. Low or sparsely growing Lineids were also favourable; thus, the larvae were abundant in water in which *Carex* had been largely destroyed by

cattle [*cf.* **20** 91]. They were scarce in water that was completely covered with plants of any sort [*cf.* **23** 107, 108] and did not occur in water devoid of vegetation, or in the presence of *Sphagnum*, even though the pH was 6·9 [*cf.* **19** 26]. No larvae were found in turf-pits, ditches or lakes in swamps on high ground in which the water had an acid reaction and the vegetation consisted chiefly of *Sphagnum* and filamentous algae. On the other hand, they were abundant in turf-pits in low-lying swamps with rich vegetation and a pH of 6·9–8.

[Pogol'skiĭ (V. G.).] **Погольский (В. Г.). Application of Mud impregnated with Naphtha Products for treating Water infested with Anophelines.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 p. 644. Moscow, 1940. [Recd. 1943.]

In preliminary experiments in Odessa in July 1940, complete mortality of Anopheline larvae in two artificial water reservoirs was obtained by the use of the thick oily mud from the bottom of a pit over which railway engines are washed. This mud is formed from the thick layer of dust washed from the lubricated parts of the engines. It accumulates in the ditch after the water has run off and is periodically removed. It was applied at the rate of about 1 oz. to 15 sq. ft. of surface, and was broadcast by hand, which gave a better distribution over a larger surface than a shovel. Five applications were made at intervals of 10 days, and no larvae were ever recovered in samples of water taken 24 hours after treatment.

[Gromov (A. S.).] **Громов (А. С.). Sur une propriété inconnue du poisson** *Gambusia.* [*In Russian.*]—*Med. Parasitol.* **9** no. 6 p. 645. Moscow, 1940. [Recd. 1943].

Laboratory observations in eastern Turkmenistan showed that *Gambusia affinis holbrooki* can survive out of water for considerable periods and so can be easily transported over short distances for release against Anopheline larvae. At room temperature, the fish lived for up to 12 hours on damp filter paper and up to 15–20 hours on a damp cloth if covered with a piece of muslin. Placed on a plate into which 1–2 cc. water was periodically poured, they survived for 2 days, or for 2½ days if the water was poured on to a cloth in the plate. When released into water, they behaved normally. They succumbed more quickly to crowded conditions in a small quantity of water than when without it. If wrapped in muslin, they died in 10–12 hours even if there was sufficient moisture, probably because the muslin stuck to the gills and interfered with respiration.

[Pospelova-Shtrom (M. V.).] **Поспелова-Штром (М. В.).** *Ornithodorus tartakovskyi* **Ol., 1931 as a Vector of Tick Spirochaetosis.** [*In Russian.*]—*Med. Parasitol.* **9** no. 6 pp. 618–622, 6 refs. Moscow, 1940. (With a Summary in English.) [Recd. 1943.]

Ornithodoros tartakovskyi, Olenev, is common in the burrows of small rodents in the desert-steppe regions of Central Asia, but has not been recorded from dwellings. Investigations to determine whether it is a vector of relapsing fever [*cf.* *R.A.E.*, B **23** 72] were carried out in Moscow in the summer of 1939 with nymphs and adults collected in April from the burrows of hedgehogs near Ashkhabad, in south-western Turkmenistan. Spirochaetosis was produced in laboratory mice by the feeding of the ticks, which showed that the latter were naturally infected. The strain obtained was maintained by serial passage in mice and was not pathogenic to guineapigs ; it did not even cause a latent infection in them. The infected ticks did not, however, always transmit the

disease to mice. In cases of transmission, the incubation period lasted 5–8 days, the spirochaetes usually appearing on the sixth day. Injection of blood from the mice caused a transient infection (occasionally latent) in rabbits and white mice, but did not infect a hedgehog (*Erinaceus europaeus*), goldfinch or tortoise. Jerboas (*Meriones*) from Daghestan, where *O. tartakovskyi* does not occur, proved highly susceptible to infection produced by intraperitoneal injection of an suspension of the internal organs of ticks that had died 3–4 hours previously. It is suggested that jerboas, probably including *Rhombomys opimus*, which occurs in Central Asia and is often associated with *O. tartakovskyi*, may serve as reservoirs of this strain of spirochaete in nature. It differs from the strain transmitted by other species of *Ornithodoros*, such as *O. tholozani*, Lab. & Mégn. (*papillipes*, Bir.) and *O. verrucosus*, Olenev, Zas. & Fen. [*cf.* **17** 226; **26** 8] in its pathogenicity to laboratory animals and the characteristics of the disease it produces, and is probably identical with the species named *Spirochaeta latyschewi* by Sofiev [see next abstract].

[Sofiev (M. S.).] **Софиев (М. С.). A new Species of Relapsing-fever Spirochaete, *Sp. latyschewi* sp. n.** [*In Russian.*]—*Med. Parasitol.* **10** no. 2 pp. 267–271, 1 graph. Moscow, 1941. [Recd. 1943.]

Spirochaeta persica (*sogdiana*), which causes relapsing fever in man, has been isolated by various workers in Central Asia, where it is maintained in nature in rats, domestic mice, dogs and hedgehogs and is transmitted by *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.). In 1934, Latuishev isolated spirochaetes from the jerboa, *Rhombomys opimus*, and the bat, *Rhinolophus ferrum-equinum*; the strain from the jerboa was pathogenic to man. In experiments by the author, begun in 1934, 12 strains of spirochaetes isolated from man, dogs, rats, domestic mice, hedgehogs and *O. tholozani* in Central Asia did not differ substantially from one another and were maintained in guineapigs, which are very susceptible to *S. persica*. When transmitted to man by inoculation of infected blood or by the bite of *O. tholozani*, they caused a disease that was indistinguishable from ordinary tick-borne relapsing fever. Four strains, however, isolated from *R. opimus* in southern Turkmenistan and *Gerbillus eversmanni* in eastern Uzbekistan and from *O. tartakovskyi*, Olenev, taken in the burrows of these two jerboas, were not pathogenic to guineapigs, rats and dogs, and caused only a short-lived infection in mice and rabbits. In experiments with naturally infected nymphs and males of *O. tartakovskyi* that were taken in a burrow of *G. eversmanni* and were shown to be infective to mice, the ticks fed on man reluctantly and the disease was transmitted in only one case out of six. All four strains, however, were readily transmitted to man by inoculation of infected blood and they were about equally pathogenic. It is considered that these strains and the one isolated by Pospelova-Shtrom [see preceding abstract] represent a species that is distinct from *S. persica*, and the name *S. latyschewi*, sp. n., is proposed for it. Its vector, *O. tartakovskyi*, does not normally attack man, but should such attack occur, transmission of the spirochaete could take place.

[Afanas'ev (S. F.).] **Афанасьев (С. Ф.). Contribution to the Question of the Use of the Distillate from Coke Stills against Mosquito Larvae.** [*In Russian.*]—*Med. Parasitol.* **10** no. 2 pp. 287–290, 1 ref. Moscow, 1941. [Recd. 1943.]

Investigations on the use against Anopheline larvae of a distillate from coke stills [*cf. R.A.E.*, B **27** 173] were continued in the northern Caucasus in 1939, when over 16,000 sq. yards of water was treated. It formed an elastic film that withstood slight rain and wind with a velocity of about 5 miles per hour, and killed most of the larvae and pupae in an hour. If the film was not broken

by strong wind or rain, the water remained free from eggs or larvae for up to 9 days. A table shows the rates of application required at different temperatures and in the presence of different amounts of aquatic vegetation. Applied in an aquarium with dense submerged vegetation at a dosage ten times as high as that normally used for treating infested waters, the distillate was not harmful to *Gambusia*. When in glass jars, the fish succumbed in 2 days in the presence of an unbroken film of the distillate on the water. Slowly flowing water in a ditch 40 ins. wide was effectively treated by allowing the distillate to drip from a muslin wick, and filling the entire width of the ditch a little lower down with leafy branches to make the liquid spread. It was applied at the rate of 180 drops a minute, the whole of the surface of the water was covered with a thin film in 15 minutes, and the film was maintained for 4½ hours.

The specific gravity of the distillate used does not exceed 0·925 at 15°C. [59°F.], its flash-point is not above 35°C. [95°F.], it begins to boil at a temperature of not more than 138°C. [280·4°F.], and its viscosity at 50° Engler does not exceed 1·60. Samples characterised by somewhat lower indices than these maxima were the best larvicides.

[Denisov (L. A.).] **Денисов (Л. А.). An Experiment on the Application of a Suspension of Paris Green in the Control of the Larvae of the Malaria Mosquito.** [*In Russian.*]—*Med. Parasitol.* **10** no. 2 p. 291. Moscow, 1941. [Recd. 1943].

In the summer of 1940, large areas of water infested with Anopheline larvae in the north-west of the Province of Moscow were sprayed with a mixture of Paris green and crude oil in water, using about 13 oz., 1½ pints and 18 gals., respectively, per acre, and 93–96 per cent. of the larvae were killed. To prevent the suspension from separating in the sprayer, it had to be frequently agitated.

[Savitzkiĭ (V. I.).] **Савицкий (В. И.).** *Anopheles bifurcatus* **in the Environs of Kiev.** [*In Russian.*]—*Med. Parasitol.* **10** no. 2 pp. 291–292. Moscow, 1941. [Recd. 1943.]

Larvae and adults of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) were observed in several localities near Kiev in 1939, particularly in two summer resorts, both of which were situated in forests on the banks of rivers that were in flood. The larvae were numerous in flood water, and the adults constituted 40 per cent. of all mosquitos taken in a day-time shelter in one resort. The larvae are also common in water tanks in orchards near Kiev.

Sokolov (N. P.). **Influence of Sun Radiation on the Distribution of** *Anopheles hyrcanus* **Larvae under Conditions of Rice Fields.**—*C. R. Acad. Sci. URSS* (N.S.) **33** no. 2 pp. 166–169. Moscow, 1941. [Recd. 1943.]

An account is given of observations in Uzbekistan in 1938 on the effect of sunlight on the distribution of larvae of *Anopheles hyrcanus*, Pall., and of various species of algae in rice-fields. It was found that there were fewer algae and somewhat fewer larvae, especially of the first three instars, in zones that were artificially shaded to exclude any direct rays. Larvae, particularly those of the fourth instar, and pupae could withstand a higher amount of shading than that afforded by the kinds of rice grown in the district.

Mahaffy (A. F.), Smithburn (K. C.), Jacobs (H. R.) & Gillett (J. D.). **Yellow Fever in western Uganda.**—*Trans. R. Soc. trop. Med. Hyg.* **36** no. 1 pp. 9–20, 1 map, 8 refs. London, 1942.

In an attempt to demonstrate the recent occurrence of yellow fever in a part of Bwamba County, western Uganda, where an important focus with some 20 per cent. immunity had been shown to exist [*cf. R.A.E.*, B **30** 97], 97 persons who had been found to be non-immune in October 1939 or January 1940 were bled again in April 1941 and a further 71 in June 1941, and 26 and 22, respectively, were found to have acquired immunity. As the area had a population of about 5,000, this indicated that over 1,100 cases of yellow fever had occurred. There was evidence that the outbreak was confined to a limited area. Nearly 100 of the non-immune group originally chosen for the experiment could not be traced and some were stated to have died. Many of those who had recently become immune had had a febrile illness during the previous year, and it was thought probable that most of the cases were mild, and the number of severe and fatal cases not sufficient to attract attention. A programme of mass vaccination in the Toro District east of Bwamba was immediately instituted and an immune zone formed. The presence of the disease in Bwamba was conclusively demonstrated in June 1941 when two cases in which a clinical diagnosis of yellow fever seemed justified were found, and a strain of the virus was isolated from one of them. Two other strains were isolated from batches of several hundreds of *Aëdes simpsoni*, Theo., caught in nature in July. Mass vaccination excluded the possibility of further cases.

The procedure followed in isolating the virus from the mosquitos is described. It failed to become established by continuous passage in mice but readily did so after one passage through a rhesus monkey. The mosquitos from which one strain was isolated were caught in the immediate neighbourhood of the house of the patient from whom the first strain came, and the others from a locality where 21 out of 35 persons tested had recently become immune. *A. simpsoni*, which was the only species that could be captured in daytime in large numbers, breeds chiefly in the axils of plants [**19** 69]. The adults were most numerous in the cultivated areas round buildings, where they comprised 97 per cent. of all mosquitos taken. They feed readily on man during daylight and are more active in bright than in dull weather, but were not taken in houses. Only one adult of *A. aegypti*, L., was taken, and though larvae were found in tree-holes, it is evidently too rare in Bwamba to be of any importance as a vector of yellow fever. In addition to *A. simpsoni*, *A. africanus*, Theo., *Eretmapodites chrysogaster*, Grah., and *Mansonia* (*Taeniorhynchus*) *africana*, Theo., which are known to be potential vectors, were found in the uninhabited forest on the edge of which the natives live in scattered huts. It is thought that outbreaks are initiated by forest vectors and that once the disease has become established in man, the principal vector is *A. simpsoni*. The fact that outbreaks progress slowly is probably due in part to the habits of the vector and in part to the fact that the population is scattered.

Scharff (J. W.) & Tweedie (M. W. F.). **Malaria and the Mud Lobster.**—*Trans. R. Soc. trop. Med. Hyg.* **36** no. 1 pp. 41–44, 2 figs. London, 1942.

The burrowing of mud lobsters (*Thalassina anomala*, Hbst.) may render antimalarial measures ineffective in swampy areas near the sea in Malaya by providing unsuspected breeding places for Anophelines and by undermining tidal bunds. As a result of experiments in Singapore, it was found that they can be destroyed by pouring $\frac{1}{4}$–$\frac{1}{2}$ gal. of a mixture of lime and water (5 lb. to 3 gals.) into the holes and then filling them with tightly packed sand. Burrowing up through a tidal bund can be prevented by burying a layer of fibrous material

from the trunks of coconut trees soaked in coal tar, 1 ft. from the top of it. The crabs of the genus *Sesarma* usually associated with these holes use them as a refuge but do not make them.

RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **On Relation of mechanical Obstruction and Shade to Ovipositing of** *Anopheles culicifacies*.—*J. exp. Zool.* **91** no. 2 pp. 303–329, 6 figs., 10 refs. Philadelphia, Pa., 1942.

The following is largely based on the authors' summary of experiments designed to ascertain why the breeding of *Anopheles culicifacies*, Giles, in fields of growing rice in south-eastern Madras practically ceases when the rice is more than 12 ins. high [*R.A.E.*, B **29** 9, 147–148]. It appeared that some factor that prevented oviposition was concerned, since egg surveys in rice-fields failed to yield those of *A. culicifacies*, but when eggs were experimentally introduced, larvae hatched and developed normally. Observations were therefore made of the amount of oviposition that occurred in small seepage-filled borrow-pits that were or were not provided with various types of mechanical obstruction or shade. The chief types of mechanical obstruction used were glass rods vertically placed to simulate rice plants, test tubes with living rice plants so situated that the plants could not affect the water or soil because they were not in contact with them, and barriers of vertical bamboo strips or of bamboo leaves and tender shoots placed to surround the pits and covered with a wire-screen roof. The effect of shade, alone or in combination with a barrier, was tested by covering pits with wooden or wire-screen boxes open on one side. Each type of mechanical obstruction played an important part in repelling the ovipositing females, but shade by itself had no appreciable influence on egg-laying, nor did it appear to have any secondary effect by altering the water conditions. It is suggested that mechanical obstruction offered by rice plants is the chief limiting factor in keeping *A. culicifacies* out of growing rice fields. When tall rushes were planted instead of rice, the same succession of Anophelines occurred, *A. culicifacies* giving way to the usual rice-field species [*loc. cit.*].

SUNDAR RAO (S.). **Observations on Filariasis in Lakhipur and Binakandy Tea-gardens (Cachar District, Lower Assam).**—*Indian J. med. Res.* **30** no. 2 pp. 345–350, 1 map, 2 refs. Calcutta, 1942.

Filariasis, caused chiefly by *Filaria* (*Wuchereria*) *malayi*, is endemic in seven of the nine villages that comprise the tea gardens of Lakhipur and Binakandy in the south-east of Cachar District, Lower Assam. It is said to have been introduced some 30 years ago. About half the population, 2,445 persons, were examined for signs of the disease in 1941, and 110 were found to be positive, one showing hydrocele and all the others elephantiasis of the extremities. Microfilariae were found at night in the peripheral blood of ten of the latter and in 105 of the negative cases. Five of the 115 carriers, all from the village of Lakhipur, were infected with *F.* (*W.*) *bancrofti* and the remainder, including one from Lakhipur, with *F. malayi*. Comparison with earlier work showed that the infection rate had remained steady since 1938, while the number of cases of elephantiasis had increased in all the villages, but there did not appear to have been any spread of infection to neighbouring villages.

The mosquitos found during the survey were *Mansonia* (*Mansonioides*) *annulifera*, Theo., *M.* (*M.*) *uniformis*, Theo., *M.* (*M.*) *indiana*, Edw., *Culex fatigans*, Wied. (in Lakhipur only), *C. vishnui*, Theo., *C. tritaeniorhynchus*, Giles, *C. gelidus*, Theo., *Aëdes* (*Aëdimorphus*) *vexans*, Mg., *Armigeres obturbans*, Wlk., *Aëdes* (*Banksinella*) *lineatopennis*, Ludl., *Anopheles hyrcanus*, Pall., *A. h. nigerrimus*, Giles, *A. subpictus*, Grassi, *A. pallidus*, Theo., and an undetermined

species of *Culex*. The villages situated in extensively cultivated land were almost free from infection, whereas those in swampy areas had high infection rates.

Pierce (W. D.). **Utilization of the Black Widow Parasite, and further Data on Spiders and Parasites.**—*Bull. S. Calif. Acad. Sci.* **41** pt. 1 pp. 14–28. Los Angeles, Calif., 1942.

Further research in the sand dunes of Los Angeles County, California [*cf.* *R.A.E.*, B **28** 223] showed a great decrease in the numbers of *Latrodectus mactans*, F., in the type locality of its Scelionid egg-parasite, *Baeus californicus*, Pierce, but also showed that the parasite does not occur in other parts. It is apparently confined to the depression in which it is found by the almost barren sands surrounding it and was probably introduced from tropical America through the washing ashore of some object containing a parasitised egg sac. It has been established in Hawaii [**28** 223–224], but further supplies were asked for in 1941. A search on 30th May yielded two parasitised egg sacs and one female *Baeus* waiting for a female of *L. mactans* to deposit its eggs. From these, 14,124 parasites were bred during the summer, spiders and eggs to provide host material being received from several localities. Three consignments of parasitised eggs were sent to Hawaii, where 3,000 parasites were subsequently released, and 134 colonies representing 3,934 parasites were distributed locally for release.

About 5 per cent. of the egg sacs received from various localities were parasitised by *Pseudogaurax signata*, Lw. The mean number of puparia per sac was 13, and 622 spiders and 126 flies emerged from 24 parasitised egg sacs. On the basis of a normal emergence of 305 spiders per sac, this represented 91·51 per cent. control. Adults of the Chloropid lived up to 71 days.

Only 9 egg sacs parasitised by *B. californicus* have been taken in the field since it was first found in 1938, all from the original site. Data are given on the number and sexes of parasites per sac in the field and laboratory. The mean yield of sacs in the laboratory was 178 females and 18 males, but one case in which all the 43 parasites emerging from a sac were males may indicate parthenogenesis [*cf.* **28** 224]. The highest number of parasites per sac was 417. The maximum number of offspring per female so far proved is 160. Mean longevity was 34·19 days, but females were able to overwinter and remain fertile for 3–4 months. The developmental period was 20–29 days in 72 cases. As the spiders live several years and do not oviposit between October and March, the parasites must, if they are to be effective, live long enough to bridge this gap. Adults kept at 32–40°F. were still alive after 9 days, but none survived when the temperature fell to 24°.

In conclusion, it is pointed out in favour of the propagation of *Baeus* as against *Pseudogaurax* that the latter was recorded as a parasite of *L. mactans* as long ago as 1896 but had achieved only 4·8 per cent. parasitism in southern California in 1941 and was recovered from only 20 out of 60 Californian localities, that it attacks the eggs of at least three other spiders, whereas *Baeus* does not attack other species, that a parasitised egg sac yields 1–417 *Baeus* but only 1–40 *Pseudogaurax*, that on an average *Baeus* destroys 98·71 per cent. of the eggs in a parasitised sac while *Pseudogaurax* destroys only 91·51 per cent., that the ratio of issuing spiders to parasites from parasitised egg sacs is 5 : 1 in the case of *Pseudogaurax* and 1 : 49 in that of *Baeus*, and that *Baeus* can be propagated in the laboratory at least 12 times as fast as *Pseudogaurax*.

Many spiders and egg sacs of species other than *L. mactans* were received and are discussed. One that has been known in the locality for several years as the false widow spider has been identified as *Teutana grossa*, Koch, and is a new record for California. It belongs to the same family as *L. mactans*, which it often kills. It is not known whether it is poisonous. *Peucetia viridans*, Hentz, was also received. A bite from a female of this species caused considerable swelling and pain.

JENKINS (C. F. H.). **Some Insect Pests of Military Camps.**—*J. Dep. Agric. W. Aust.* (2) **19** no. 1 pp. 13–37, 20 figs., 10 refs. Perth, W.A., 1942.

This comprehensive paper on the Arthropods that cause annoyance or spread disease in military camps, with special reference to Western Australia, deals chiefly with the life-history and control of *Musca domestica*, L., mosquitos, fleas and the lice, *Pediculus humanus*, L. (*corporis*, DeG.), *P. h. capitis*, DeG., and *Phthirus pubis*, L., and their relation to the spread of disease, and includes short notes on other Diptera, cockroaches, *Cimex lectularius*, L., *Pediculoides ventricosus*, Newp., and *Latrodectus hasseltii*, Thorell, the only spider that causes serious poisoning in man in Western Australia.

JEX-BLAKE (A. J.). **Bee-stings.**—*E. Afr. med. J.* **19** no. 3 pp. 74–86, 12 refs. Nairobi, 1942.

The situation and nature of the poison glands of bees and wasps are briefly described, and an account is given of the chemical nature of the venom of the European honey-bee, *Apis mellifica*, which has been shown by physiological analysis to include an inflammation-producing substance, a convulsant poison and a paralysing poison, and of the signs and symptoms that occur in man following bee stings causing mild or violent reactions. Acquired immunity from bee stings and the phenomenon of hypersensitiveness to them, which may take the forms of allergy or anaphylaxis, are discussed, and evidence is adduced against the theory that where the symptoms are very severe, the sting has penetrated a vein or venule. Native Kenya bees [*A. mellifica adansoni*, Latr., and *A. intermissa*, Butt.-Reep.] are reputed to be much more savage than English hive bees, and some consider that the individual stings are more severe. Swarming may occur at any time of the year. Descriptions are given of four cases in which multiple stings were followed by rapid recovery and of two cases of fatal stings in Europeans. It is thought that half a dozen or more natives are killed by bees in Kenya every year. Similar losses have occurred among domestic animals. Methods of avoiding stings and of treating them are briefly described.

PAPERS NOTICED BY TITLE ONLY.

DE OLIVEIRA (S. J.) & VERANO (O. T.). **Estudo sôbre as cerdas clipeais das larvas de** *Anopheles* (*Nyssorhynchus*) *oswaldoi* (**Peryassú, 1922**) **e** *Anopheles* (*Nyssorhynchus*) *argyritarsis* **R. Desvoidy, 1827, da Baixada Fluminense (Diptera, Culicidae).** [A Study on the clypeal Setae of the Larvae of *A. oswaldoi* and *A. argyritarsis* of the Lowlands of Rio de Janeiro.]—*Rev. brasil. Biol.* **2** no. 3 pp. 353–360, 12 figs., 12 refs. Rio de Janeiro, 1942.

VARGAS (L.). **El huevecillo de** *Anopheles* (*Anopheles*) *eiseni* **Coquillet, 1902.** [A Description of the Egg of *A. eiseni*.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 2 pp. 185–187, 2 figs., 6 refs. Mexico, D.F., 1942. (With a Summary in English.)

NAUCK (E. G.) & WEYER (F.). **Versuche zur Züchtung von Rickettsien in explantiertem Läusegewebe.** [Experiments in culturing *Rickettsia* spp. in explanted Tissue of *Pediculus humanus*, L.]—*Zbl. Bakt.* (I. Orig.) **147** pt. 6 pp. 365–376, 4 figs., 10 refs. Jena, 1941. [Recd. 1943.]

IMPERIAL INSTITUTE. **Quarterly Bibliography on Insecticide Materials of Vegetable Origin, Nos. 9–20 (November 1939 to September 1942).**—*Bull. imp. Inst.* **38** nos. 1–4 pp. 62–65, 203–208, 346–352, 447–452 ; **39** nos. 1–4 pp. 41–48, 143–147, 269–275, 391–396 ; **40** nos. 1–4 pp. 28–33, 131–137, 199–206, 282–289. London, 1940–42. [*Cf. R.A.E.*, B **28** 56.]

BRIGHTWELL (S. T. P.). **Fumigation by Smokes** [Aerosols] **with special Reference to Derris and Pyrethrum. A Survey of recent Literature.**—*Bull. imp. Inst.* **40** no. 1 pp. 6–11, 30 refs. London, 1942.

HARGREAVES (W. H.) & MACKENZIE (K. G. F.). **Spider Bite simulating Acute Abdomen.**—*J. R. Army med. Cps* **78** no. 1 pp. 37–39, 1 fig., 3 refs. London, 1942.

A soldier admitted to hospital in Palestine in August 1940 with a condition resembling acute appendicitis had been well until two hours previously, when he was bitten on the buttock by a female of *Latrodectus lugubris*, Duf. Intense pain like cramp spread throughout his back, head and limbs within half a minute ; later, it spread over the front of the body and was accompanied by abdominal pain and vomiting. He was given morphia and, intravenously, 10 cc. of a 10 per cent. solution of calcium gluconate. He remained in a collapsed condition for three days, and pain and abdominal rigidity and tenderness persisted. There was still some weakness and stiffness of the limbs after two weeks. Two species of *Latrodectus* occur in Palestine, *L. lugubris* and *L. tredecimguttatus*, Rossi.

PIROSKY (I.), SAMPAYO (R.) & FRANCESCHI (C.). **Suero anti** *Latrodectus*. **1. Obtención y purificación.** [A Serum for Use against the Poison of *Latrodectus*. 1. Preparation.]—*Rev. Inst. bact. "Carlos G. Malbran"* **11** no. 1 pp. 83–93, 1 fig., 13 refs. Buenos Aires, 1942.

In the experiments described, a serum was obtained by injecting extracts of the cephalothorax of 1,436 and 820 females of *Latrodectus mactans*, F., into two horses over periods of 14 and 8 weeks, respectively. It was concentrated by treatment with sodium sulphate or by peptic digestion, and guineapigs inoculated with it shortly after receiving an injection of the poison survived, whereas the controls died in 24 hours [*cf. R.A.E.*, B **28** 254]. It is considered that the method of peptic digestion is of importance in the preparation of serum for the treatment of human cases, since it reduces the quantity of the inoculum required.

JOHNSON (C. G.). **Some quantitative Aspects of Scabies Parasitology. (Abstract.)** —*Ann. appl. Biol.* **29** no. 3 p. 310. London, 1942.

It was found by removing all ovigerous females of *Sarcoptes* [*scabiei*, DeG.] from patients (soldiers) that the average number of such females per patient was only 14. In 52 and 76 per cent. of the cases, not more than 6 and 14 were found, respectively, and only 12 per cent. had more than 30. A patient is occasionally found with more than 100, but this is rare. The reproductive potential of *Sarcoptes* is enormous, but mortality is extremely high, and infestations may die out spontaneously. In 85 per cent. of all cases, the hands and wrists are infested, and more than half of the mites removed came from these sites.

KEARNS (H. G. H.). **The Control of Flies in Country and Town.**—*Ann. appl. Biol.* **29** no. 3 pp. 310–313. London, 1942.

Notes are given on the habits and control of *Forcipomyia* (*Ceratopogon*) *bipunctata*, L., *Culicoides obsoletus*, Mg. (*Ceratopogon varius*, Winn.) and the Tabanid, *Haematopota pluvialis*, L., which cause considerable annoyance in rural areas in England. The Ceratopogonids breed in decaying vegetation and may attack man at any time of day, but are most active in the late afternoon and evening. They can be repelled for about 5 hours by a light application of pyrethrum extract in petroleum or olive oil (1·0 per cent. pyrethrins) or for longer by substituting 10 per cent. dodecyl thiocyanate or *n*-butyl carbitol thiocyanate for the pyrethrum extract. *H. pluvialis* occurs in most parts of

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the country, but is abundant only in low-lying areas intersected with canals. The repellents are not effective against it ; a sustained application of witch-hazel gives the best relief from the effects of its bite.

In many parts of the country, more particularly the pasture areas of the west, several Diptera, particularly *Pollenia rudis*, F., *Musca autumnalis*, DeG., *Pyrellia lasiophthalma*, Macq., and *Chloropisca notata*, Mg. (*circumdata*, Mg.) swarm in autumn in hollow trees and buildings. *C. notata* does so in summer also, but swarming of the other species is an act of hibernation. They first appear on the outside of windows in late July or early August, frequently in the same site year after year, and gradually increase in numbers, entering the houses when the evenings grow cold, and remaining indoors until April. They are readily killed by atomising pyrethrum extract or dodecyl or butyl carbitol thiocyanate in odourless kerosene of low aromatic content, or in a highly refined petroleum oil if the oily deposit is of no consequence. For use in hand atomisers and low-pressure spray guns, 0·25–0·5 per cent. total pyrethrins or 4 per cent. thiocyanate is satisfactory. Repeated applications must be made in autumn, as the flies arrive in batches over a period of 2–8 weeks. Daily applications are sometimes necessary. If most of the flies are killed at this time, the annoyance of the emergence from hibernation in spring is largely avoided, and in about 70 per cent. of the infestations under observation the next winter's numbers were markedly lower. Hibernation often occurs in the roof spaces of large buildings such as churches, where control is difficult owing to air draughts, but satisfactory results have often been obtained by using paint spray guns in which the jets are modified to give a very large ratio of compressed air to liquid. Hundreds of thousands of flies were killed in the open roof spaces of a church by atomising pyrethrum extract in kerosene (0·5 per cent. total pyrethrins) from floor level at the rate of 2 pints per 100,000 cu. ft. air space. Another method that has proved of value in some instances is the provision of easy means of entry and exit, such as skylights in roofs and walls of west and south-west aspects. *Pollenia rudis* usually swarms in relatively isolated buildings on the crest of rising pasture ground with a high population of earthworms, on which its larvae are parasitic. Control of the worms by means of mowrah-meal dressings reduces the numbers of this species.

Serious outbreaks of house-flies [*Musca domestica*, L.] and blowflies have occurred in several bombed towns and cities as a result of breeding in accumulations of food-stuffs left exposed among bricks and rubble after food-stores have been damaged. Such breeding was most satisfactorily controlled by liberal applications of a tar-oil emulsion (2·0 per cent. oil) to the surface of the piles of débris. This repelled egg-laying females and killed up to 90 per cent. of the eggs with which it came in contact. Spraying was repeated every 7–10 days, and each day that clearing was in progress, the freshly exposed site was sprayed.

Robinson (G. G.). **The quantitative Interaction of Spray Fluid and active Principle in determining the Toxicity of a Pyrethrum Preparation to the Argasid Tick,** *Ornithodorus moubata* **Murray.**—*Ann. appl. Biol.* **29** no. 3 pp. 290–300, 3 graphs, 14 refs. London, 1942.

The tests reported in this paper were incidental to research on the possibility of using contact poisons for the control of *Ornithodoros moubata*, Murr., in African huts, in which fumigation is impracticable. They were undertaken to show the effect of dilution with medium shell oil, the specification for which is given, on the toxicity of a stock solution containing 1·3 per cent. weight in volume of pyrethrins in the same oil. The ticks were reared and treated in the dark at 30°C. [86°F.] and approximately 50 per cent. relative humidity and were fed about 24 hours before treatment. Spraying them directly proved unsatisfactory, as mortality was zero until a large enough dose had accumulated to affect the lateral spiracles, after which it was complete, and tests were

therefore carried out with first-stage nymphs by putting them on the smooth side of filter papers bearing known deposits of spray for 24 hours, and with third-stage nymphs by lightly fixing them on their backs, spraying them in this position and releasing them on clean filter paper after two hours. By these methods, the insecticide reaches the thin articular membranes of the legs, which are relatively easily penetrated, and a graded mortality is obtained, depending on both deposit and concentration ; the former method is preferable, since the deposit is more easily applied and measured, and smaller nymphs can be used, eliminating the trouble involved in rearing the later instars. First-stage nymphs were treated with sprays containing 1·3, 0·65, 0·39 and 0·13 per cent. pyrethrins, and third-stage nymphs with the two higher concentrations.

The results obtained showed that for the lower deposits of pyrethrins, the toxicity of a given deposit increases as the concentration of pyrethrins in oil decreases, the loss due to dilution being more than counterbalanced by the gain due to the increased contact with the tick caused by the extra bulk of the diluent, whereas the higher deposits are more toxic if they are more concentrated, the inherent toxicity of the pyrethrins increasing constantly with deposit and concentration, and increase of bulk being of little value when most of the vulnerable parts of the tick are covered, until the spiracles begin to be flooded.

In further tests on first-stage nymphs, a solution containing 1·04 per cent. pyrethrins in a mixture of eight parts of shell medium oil and two of shell odourless distillate, a lighter and more volatile oil, was rather more toxic than one containing 0·52 per cent. pyrethrins in the same medium, when the same quantities of active principle were deposited. There was less increase of availability (and toxicity) with bulk for the lower deposits in these solutions than when the heavier oil only was used as a diluent, since the deposit spread over the tick's cuticle much more rapidly. The toxicity of the mixture was considerably increased by the partial replacement of medium oil by odourless distillate.

Analysis of the results obtained by Calloway and Musgrave with two concentrations of Lethane 384 [*n*-butyl carbitol thiocyanate] in odourless distillate and two of pyrethrins in medium oil against the eggs of *Cimex lectularius*, L. [*cf. R.A.E.*, B **29** 12] showed that if bulk of insecticide contributes to toxicity in this case, it must act cumulatively with the active principle on a more or less compensatory basis over the whole range explored, the lack of advantage of dilution at the lower deposits being probably due to the already adequate covering of the vulnerable parts by those doses.

ROBINSON (G. G.). **The relative Toxicity of Rotenone and Pyrethrum in Oil to the Argasid Tick,** *Ornithodorus moubata,* **Murray.**—*Bull. ent. Res.* **33** pt. 4 pp. 273–281, 3 graphs, 15 refs. London, 1942.

In further investigations with contact insecticides against *Ornithodoros moubata*, Murr. [*cf.* preceding abstract], sprays of rotenone or pyrethrum in oil were applied to third-stage nymphs by the method previously described. Pure crystalline rotenone was used at the rate of 1·5 per cent. weight in volume in xylenol (as a solubiliser) and ground-nut oil (5 : 15) or in xylenol, ground-nut oil and a petroleum oil (5 : 3 : 12) ; the total replacement of ground-nut oil by petroleum oil was not practicable because it caused precipitation of rotenone. A proprietary product (Pyremist " L ") was filtered and diluted with the same petroleum oil to contain 0·15 per cent. pyrethrin I by weight ; pyrethrin II was presumably present in approximately the same amount. Specifications of the spray media are given. Statistical analysis of the results showed that within the range of deposits of rotenone tested (0·84–4·12 mmg. per sq. cm.) the solution containing petroleum oil is more toxic than that containing only ground-nut oil ; it was calculated that a deposit of 3·162 mmg. would give a kill of 57 per cent. in ground-nut oil and 97 per cent. in the mixture containing

petroleum oil, and the difference was similar throughout the experimental range. Since the vegetable and mineral oils were passive carriers of the rotenone already in solution in xylenol, the superiority of the petroleum oil spray must be due to the greater penetrating power of this oil as a carrier of the toxic solution. The mixtures of xylenol and oil without rotenone both showed negligible toxicity within the range of deposits tested. Deposits of 0·09–0·32 mmg. pyrethrin I per sq. cm. gave 40–90 per cent. mortality.

Corresponding results were obtained in tests with the pyrethrum spray and the more effective of the two rotenone solutions on engorged adult females and unfed first-stage nymphs, the most resistant and least resistant of the active stages ; the small nymphs were sprayed as they crawled on filter paper so that their dorsal surface received the insecticide. The deposits per sq. cm. required for 50 and 95 per cent. mortality of the adults were 0·265 and 0·505 mmg. pyrethrin I and 4·88 and 10·64 mmg. rotenone, while the lowest measurable deposit of pyrethrin I (0·09 mmg.) was completely lethal to first-stage nymphs and 0·33 and 2·21 mmg. rotenone gave 50 and 95 per cent. mortality.

The results obtained with third-stage nymphs were confirmed when the experiments were repeated with freshly made solutions four months later. Comparison of freshly made rotenone solutions and others that had been stored in the dark for six weeks showed no significant difference in toxicity to this stage in either medium.

Saliternik (Z.). **The macroscopic Differentiation of Anopheline Eggs according to their Pattern on the Surface of Water.**—*Bull. ent. Res.* **33** pt. 4 p. 221, 1 pl. London, 1942.

The eggs of the nine species of *Anopheles* that occur in Palestine have been found to arrange themselves on water in specific patterns, determined apparently by their structure. The species to which eggs belong can be macroscopically determined in the field by placing a number of them on a drop of water and studying the pattern that they assume. This pattern consists of parallel lines in the case of *A. maculipennis* var. *sacharovi*, Favr (*elutus*, Edw.), *A. superpictus*, Grassi, and *A. multicolor*, Camb., which breed in open unshaded water, and is angular in the case of *A. sergenti*, Theo., *A. claviger*, Mg., *A. algeriensis*, Theo., *A. hyrcanus*, Pall., *A. pharoensis*, Theo., and *A. coustani*, Lav., which prefer a shady breeding place. Means of differentiating the eggs of the members of the first group are given, and photographs illustrate the typical appearance of the pattern of eggs of each of the nine species.

Lewis (D. J.). **A Method of transporting living Mosquito Larvae.**—*Bull. ent. Res.* **33** pt. 4 pp. 227–228, 1 fig. London, 1942.

The method described has been successfully used to transport batches of several thousand living mosquito larvae over a considerable distance in the hot, dry climate of the northern Sudan. Each of a series of perforated metal trays is covered with a square of cloth, which is loosely fastened beneath it. Water containing the larvae is poured into the tray and allowed to drain away, leaving the larvae stranded. Metal strips are crossed over the tray to support another one above it and several trays are stacked in a tin, which is then closed with a lid. In hot weather, the tin may be wrapped in a wet cloth. The larvae can live for several days in the cool, damp atmosphere of the tin, and adults often emerge during the journey. Any gelatinous algae in the water from which the larvae are taken must be removed.

David (W. A. L.). **The Utilisation of Waste Lubricating Oil in Mosquito Larvicides.**—*Bull. ent. Res.* **33** pt. 4 pp. 235–240, 5 refs. London, 1942.

The following is based on the author's introduction and summary. War conditions render large quantities of waste lubricating oil available in certain

centres [*cf.* *R.A.E.*, B **30** 110] and also make economy in petroleum products desirable. Experiments with nine samples of waste oils showed that it was possible to blend any of them with kerosene and Diesel oil to form serviceable mosquito larvicides. It is concluded from the results that blends containing 25–30 per cent. waste oil are less effective than an approved commercial sample [**31** 23] when applied at the same dosage, but give good results when applied at a higher dosage that is nevertheless within the range commonly applied in the field (4–6·7 fl. oz. per 100 sq. ft.). The higher dosage is not necessary when only Anopheline larvae have to be controlled. Blends containing only 10–20 per cent. waste oil are quite as effective as an approved commercial sample. The waste oils varied considerably in viscosity and were black owing to the presence of suspended particles. They would probably have to be strained before use to avoid choking the spray nozzle.

MELLANBY (K.), JOHNSON (C. G.), BARTLEY (W. C.) & BROWN (P.). **Experiments on the Survival and Behaviour of the Itch Mite,** *Sarcoptes scabiei* **DeG. var.** *hominis*.—*Bull. ent. Res.* **33** pt. 4 pp. 267–271, 3 refs. London, 1942.

Adult females of *Sarcoptes scabiei*, DeG., removed from scabies patients were killed by exposure for 10 minutes to a temperature of 120°F. or for 30 minutes to 117·8°F. Atmospheric humidity had no effect on the thermal death point as the mites were killed by heat before the effects of desiccation could manifest themselves. Females kept for 12 hours at 73 or 55°F. had the same thermal death point as others used immediately after removal from the host. The period of survival away from the host varied according to temperature. No females lived as long as two days at about 82°F. and 90 per cent. relative humidity, many dying within 24 hours ; most died within a week at about 55°F. and the same relative humidity, but a few survived longer, two until the thirteenth and one until the fourteenth day. The mites did not survive so long at 32 and 41°F. as at 55°F. Little movement occurred below 68°F, and none below 59°F. In a temperature gradient, there was a general movement towards the warmest point. The mites never went below 75°F., and those that were placed where the temperature was lower than this moved towards warmth, but no avoiding reaction to high temperature was shown, and all were eventually killed by heat. They did not react in any way to unidirectional lights. The technique used in making the observations is described, and the practical bearing of the findings on the transmission and control of scabies is discussed.

PETERS (G.). **Ein neues Schädlingsbekämpfungsmittel.** [A new Substance for the Control of Pests.]—*Chemiker-Ztg* **64** no. 99–100 pp. 485–486. Köthen, 1940. [Recd. 1943.]

Trichloracetonitrile is here recommended as a fumigant against bugs [*Cimex lectularius*, L.], cockroaches and other household pests as a result of intensive practical tests in Germany made over a period of two years and involving over 50 million cu. ft. of dwelling space. It was effective at a dosage of 30 oz. per 1,000 cu. ft. with an exposure of 8 hours unless the temperature was below 20°C. [68°F.], when the exposure had to be 16–24 hours. It is a colourless liquid with a specific gravity of 1·44 at 20°C., a boiling point of 85°C. [185°F.], low specific heat and low latent heat of vaporisation, which renders evaporation simple and speedy in spite of the relatively high boiling point. The vapour is 4·95 times as heavy as air, but a uniform distribution and good penetration are easily obtained, and, as the tendency to adsorption on any surface is very low, the concentration is maintained in furnished rooms longer than that of other fumigants, and airing is very easy, only 1–2 hours being required to remove all traces. Neither the liquid nor the vapour is inflammable. Danger to man and domestic animals is very slight as, although trichloracetonitrile is about as toxic to warm-blooded creatures as ethylene oxide or methallylchloride, a

concentration of only 5–10 oz. per million cu. ft. has a strong irritant effect on the eyes and one of 50–100 oz. per million causes coughing sufficiently violent to waken sleeping persons. The entry of traces of the fumigant into neighbouring rooms is thus easily perceptible. The vapours do not damage fabrics, paint, polish or metals unless the atmospheric humidity is exceptionally high, when iron and steel may be harmed. The short periods of exposure and airing make it possible for a room fumigated in the forenoon to be occupied before nightfall. Mono- and dichloracetonitrile are even more powerful insecticides, but their other properties are less satisfactory.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). Vectors and Reservoirs of the Virus of the Spring-Summer Tick-borne Encephalitis.** [*In Russian.*]—*Arch. Sci. biol.* **59** pt. 1–2 pp. 58–71, 2 figs. Moscow, 1940. [Recd. 1943.]

This is a review and discussion of the results of the investigations carried out by the expeditions of 1937, 1938 and 1939 on the vectors and reservoirs of the tick-borne, taĭga or spring-summer encephalitis of man in the Russian Far East [*cf. R.A.E.*, B **27** 69, 239; **29** 42], where it was first observed about 1932 and causes considerable mortality. Investigations in the district of Khabarovsk in 1939 showed that the distribution of the Ixodid vectors in the field was very uneven, the numbers collected in one man-hour on different sections of the sides of a valley ranging from 4 to 174. In forests in early spring, they concentrated on plants very close to the ground, but towards the end of spring they were most numerous at a height of 10–20 ins. They were commoner on tracks made by man or animals than on either side of them, and more attached themselves to persons walking slowly than to those walking fast. Naturally infected ticks, among which *Ixodes persulcatus*, Schulze, predominated, were abundant in the first half of the summer, but the virus could not be detected in those that were collected in the second half of July or in August. This suggests that it may be rendered temporarily inactive by some environmental factor. It presumably persists and overwinters in the ticks, since the first cases of encephalitis in spring occur in April, about the time that unfed adults appear in the field. In experiments by Kozlova and Solov'ev, *Haemaphysalis concinna*, Koch, acquired the virus in the larval stage and transmitted it in the nymphal stage 10 months later. The virus was also transmitted by infected females through the egg to the following generation. In similar experiments by Skruinnik and Ruizhov, *Dermacentor silvarum*, Olen., infected in the nymphal stage, preserved the virus for 9½ months and transmitted it when adult.

Natural infection with the virus was detected in a mole, a hedgehog (*Erinaceus amurensis*) and a vole (*Evotomys rufocanus*) ; the last two are known hosts of *I. persulcatus* and *H. concinna*. Wolf cubs were experimentally infected by intracerebral inoculation, but a badger proved resistant. It is probable that an inapparent infection followed by immunity is of common occurrence in man and animals, as antibodies were present in the sera of cows, horses and healthy persons in an endemic locality. Birds may play an important part in the circulation of the virus ; ticks, chiefly nymphs of *I. persulcatus*, were taken on a number of passerines, a list of which is given. Several species of birds were infected in laboratory experiments, the infection being apparent in some of them and latent in others.

[Chumakov (M. P.), Vorob'eva (N. N.) & Sofronova (N. E.).] **Чумаков (М. П.), Воробьева (Н. Н.) и Софронова (Н. Е.). The Detection of the Virus of the Tick-borne Encephalitis of Man in certain Rodents of the Ural Forests.** [*In Russian.*]—*Arch. Sci. biol.* **59** pt. 1–2 pp. 86–91. Moscow, 1940. (With a Summary in English.) [Recd. 1943.]

The so-called spring-summer or tick-borne encephalitis of man occurs not only in the Russian Far East but also in Siberia and in the Ural regions and

White Russia [*cf. R.A.E.*, B **29** 42]. Observations in the Ural regions showed that it affects those who have been bitten by ticks in forests. *Ixodes persulcatus*, Schulze, which is a vector of the disease, is abundant, particularly near large populated centres, and readily attacks man. In view of the fact that naturally infected examples of this tick have been shown by Chumakov to transmit the virus to animals and to their own offspring for over 10 months [*cf. loc. cit.*], investigations on the natural reservoirs of the infection were begun at the end of July 1939 in two villages that were surrounded by mixed forest and in which cases of encephalitis had occurred during the preceding two years. Ticks, mostly larvae and nymphs, were collected from small mammals and a few birds and were found to be particularly abundant on squirrels, hares and chipmunks [*Eutamias*] in August and September. Some engorged nymphs taken in these months were allowed to transform into adults, and all proved to be *I. persulcatus*. Strains of virus, similar to other strains of spring-summer encephalitis from man and ticks in the Urals and the Far East, were isolated from some of the nymphs and also from the brains of hares, squirrels and chipmunks during the period when they are infested with ticks, but negative results were obtained with the brains of 14 hares and a squirrel caught in December–February, when they are free from infestation. This suggests that rodents, unlike ticks, cannot serve as reservoirs of the virus for any considerable period.

[Pavlovskiĭ (E. N.) & Solov'ev (V. D.).] **Павловский (Е. Н.) и Соловьев (В. Д.). Experimental Study of the Circulation of the Encephalitis Virus within the Organism of the Tick** *Ixodes persulcatus*. [*In Russian.*]—*Arch. Sci. biol.* **59** pt. 1–2 pp. 111–117, 1 fig., 1 ref. Moscow, 1940. (With a Summary in English.) [Recd. 1943.]

Following investigations on the circulation of the virus of spring-summer encephalitis in the body of *Haemaphysalis concinna*, Koch, in 1938 [*cf. R.A.E.*, B **27** 239], similar experiments were carried out in 1939 with adult females of *Ixodes persulcatus*, Schulze, collected in the district of Khabarovsk (Russian Far East) and allowed to feed on mice artificially infected with a strain of the virus derived from man. The ticks were dissected 5–53 days after the infecting feed, and suspensions of various organs were injected intracerebrally into healthy mice. It was thus demonstrated that starved females rapidly acquired the virus when fed on infected mice, and it penetrated into all their internal organs in 5 days and remained active. Titration showed that its virulence remained unchanged in the intestine for 25 days. Its concentration in the genitalia decreased at first, but regained its original level after 25 days. The virus in the salivary glands and brain was highly toxic. As in the case of *H. concinna*, its transmission to man and animals is effected through the saliva, while its transmission to the egg is due to its penetration through the walls of the ovary. It did not penetrate into the chitin of the integument. Some of the mice showed no symptoms after injection of the suspensions, and these were found to have become resistant to 10 minimum lethal doses of the virus introduced subcutaneously. Since either death or immunity resulted from the injection of suspensions of the intestines, salivary glands, Malpighian tubes, genitalia or brain of infected females, it is concluded that the virus does not lose any of its properties in these organs. A comparison of the results obtained with *I. persulcatus* and *H. concinna* indicates that the former is a more favourable host for the virus.

[Levkovich (E. N.) & Skruinnik (A. N.).] **Левкович (Е. Н.) и Скрынник (А. Н.). On the Preservation of the Virus of the Spring-Summer Encephalitis in the hibernating Ixodidae Ticks.** [*In Russian.*]—*Arch. Sci. biol.* **59** pt. 1–2 pp. 118–121. Moscow, 1940. (With a Summary in English.) [Recd. 1943.]

To confirm the view that the virus of spring-summer encephalitis overwinters in hibernating adult ticks, 3,566 were collected between 22nd April and 27th

May 1939 in a primeval forest (taïga), chiefly near villages, in the district of Khabarovsk (Russian Far East). Of these, 72 per cent. were *Ixodes persulcatus*, Schulze, 15 per cent. *Haemaphysalis concinna*, Koch, and 13 per cent. *Dermacentor silvarum*, Olen. The numbers of ticks taken increased as the spring advanced and averaged 19, 23 and 39 per man-hour on 25th April and 8th and 19th May, respectively. Suspensions of 56 batches of *I. persulcatus* and 24 batches of the other species, comprising 1,893 ticks in all, were injected intracerebrally into white mice, and strains of the virus were isolated from 9 of the batches of *I. persulcatus*, 5 from males, 3 from females and 1 from a mixed batch. In addition, the virus was isolated from two groups of ticks taken in May in a section of the forest where a man had contracted encephalitis between 15th and 20th April.

[Petrishcheva (P. A.) & Shubladze (A. K.).] **Петрищева (П. А.) и Шубладзе (А. К.). The Vectors of the Autumn Encephalitis in the Maritime District.** [*In Russian.*]—*Arch. Sci. biol.* **59** pt. 1–2 pp. 72–77. Moscow, 1940. (With a Summary in English.) [Recd. 1943.]

In view of the fact that the virus of autumn encephalitis in the Maritime Province of the Russian Far East had been isolated from unidentified mosquitos, an extensive attempt to ascertain the vectors there was undertaken in 1939. Lists are given of the species studied in the various phases of the investigation. About 51,000 mosquitos belonging to 11 species were taken in foci of the disease and suspensions of them were injected intranasally into mice. The only species found infected were *Culex pipiens*, L., and *C. tritaeniorhynchus*, Giles ; the infective batch of the former had been taken while attacking workmen 30 days before the first cases of the disease occurred (mid-September) and that of the latter, all of which were engorged, were collected on a horse 8 days after the occurrence of the first case of encephalitis in the locality. No infection was detected in over 20,000 mosquitos caught in rooms of encephalitic patients ; these included *C. pipiens* and *C. tritaeniorhynchus*, but consisted chiefly of *Aëdes* spp., of which *A. dorsalis*, Mg., represented 70 per cent.

In laboratory experiments with *Anopheles maculipennis* var. *messeae*, Flni., and *C. pipiens* taken in hibernation quarters near Moscow, the virus was preserved in both species for 14–17 days. Similar experiments were made in the Maritime Province with nearly 11,000 mosquitos belonging to 18 species, most of which were abundant in the foci of the disease. These mosquitos were bred or collected under conditions that excluded the possibility of natural infection, and were fed on a 10 per cent. suspension of the brains of infected mice, and in many instances also allowed to engorge on infected mice. Suspensions of the mosquitos were then inoculated into mice, and infection was thus demonstrated in 4 batches out of 7 of *Aëdes japonicus*, Theo., 2 out of 6 of *C. bitaeniorhynchus*, Giles, and 1 out of 15 of *C. tritaeniorhynchus*, the total numbers of these mosquitos in the batches being 110, 390 and 1,520 ; the virus was preserved in *A. japonicus* and *C. tritaeniorhynchus* for 20 days. It was not transmitted to mice by the feeding of artificially infected mosquitos or mosquitos collected in a focus of the disease.

It is pointed out that in the Maritime Province, mosquitos capable of transmitting the virus may be present from the end of July, and immunisation of the population against the disease should be carried out as quickly as possible, at any rate before the end of June. In view of the readiness with which *A. japonicus* acquires infection and attacks man, its control is of special importance for preventing the spread of the disease to fresh localities.

In subsidiary experiments, no infection could be demonstrated in mosquito larvae of various species when they were fed on the macerated brains of infected mice, in the resulting adults, in larvae or pupae collected in a focus of the disease, or in eggs, larvae or pupae that were the offspring of females fed on infected mouse brain or collected in the rooms of patients [*cf. R.A.E.*, B **31** 3].

HAMMON (W. McD.), REEVES (W. C.), BROOKMAN (B.) & IZUMI (E. M.). **Mosquitoes and Encephalitis in the Yakima Valley, Washington. I. Arthropods tested and Recovery of Western Equine and St. Louis Viruses from *Culex tarsalis* Coquillett.**—*J. infect. Dis.* **70** no. 3 pp. 263–266, 14 refs. Chicago, Ill., 1942.

HAMMON (W. McD.), REEVES (W. C.) & IZUMI (E. M.). **II. Methods for collecting Arthropods and for isolating Western Equine and St. Louis Viruses.**—*T. c.* pp. 267–272, 1 fig., 8 refs.

BANG (F. B.) & REEVES (W. C.). **III. Feeding Habits of *Culex tarsalis* Coq., a Mosquito Host of the Viruses of Western Equine and St. Louis Encephalitis.** —*T. c.* pp. 273–274, 7 refs.

REEVES (W. C.) & HAMMON (W. McD.). **IV. A Trap for collecting live Mosquitoes.**—*T. c.* pp. 275–277, 2 figs., 4 refs.

HAMMON (W. McD.), REEVES (W. C.), BROOKMAN (B.) & GJULLIN (C. M.). **V. Summary of Case against *Culex tarsalis* Coquillett as a Vector of the St. Louis and Western Equine Viruses.**—*T. c.* pp. 278–283, 1 graph, 36 refs.

In the first paper, it is recorded that between 15th May and 15th September 1941, the viruses of St. Louis encephalitis and the western type of equine encephalomyelitis were isolated in the Yakima Valley from 3 and 5 pools, respectively, of *Culex tarsalis*, Coq. [*cf. R.A.E.*, B **29** 194 ; **31** 49], of which 4,655 individuals were used. Negative results were obtained with 10,955 other Arthropods, 7,811 of which were mosquitos of 11 different species. As an average of 582 individuals of *C. tarsalis* was tested for each strain of virus isolated, and *Aëdes dorsalis*, Mg., *Anopheles maculipennis freeborni*, Aitken, and *Theobaldia inornata*, Will., represented 2,828, 1,925 and 1,179 of the other mosquitos, it is possible that the samples of the remaining species were too small to make the inclusion of an infected individual probable [**31** 19]. The areas from which positive mosquitos were collected were principally rural, though some were urban.

The methods of collecting the Arthropods alive and of isolating the viruses are described in the second paper. Live mosquitos were taken in a modified New Jersey light-trap and a new type of trap, which is described in the fourth paper, dry ice [solidified carbon dioxide] being used in both as an attractant [**25** 171]. In addition, certain day-biting forms were taken by hand-collecting on large animals, *Anopheles* and *Culex* by hand-collections in shelters, and *Aëdes* by sweeping in the fields. The captured individuals were sealed in glass vials, and stored and transported in dry ice. The procedure for preparing an inoculum from Arthropods is described. For the isolation of either virus, intracerebral inoculation of five mice of a strain known to be susceptible to both was proved to be more satisfactory than intracerebral inoculation of one 200-gm. guineapig or two chick embryos. The guineapig is relatively immune from St. Louis virus.

The third paper contains an account of precipitin tests showing that *C. tarsalis* feeds in nature on man, cows, horses, pigs, dogs, sheep and fowls (or possibly other birds).

The trap described in the fourth paper consists of a rectangular box ($4 \times 4 \times 5$ ft.) with a funnel 4 ft. long and 4 ft. square at the mouth, tapering to 8 ins., inserted for 15 ins. into one end, the joint being air-tight. A 100-watt lamp surrounded by a close-fitting glass shield is fastened within the funnel 6 ins. from the inner opening. A basin attached by three supports just beyond the small end of the funnel with its concave side facing towards it acts as an air baffle. A 16-in. exhaust fan moving 1,600 cu. ft. of air per minute is mounted in an opening at the opposite end of the box. A partition of 16-mesh copper gauze extends across the box, 18 ins. in front of the fan, and a pipe carries an air current from the fan exhaust over the box to just above the front of the funnel. A piece of solidified carbon dioxide is placed in the end of this pipe each evening and fumes are blown out in front of the trap. When the trap is in

operation, the velocity of the air in front of the light is such that a mosquito cannot come to rest. A cloth sleeve closes the trap when the funnel is removed, and a worker can insert his head and shoulders in it and select the insects he requires before killing the others with spray. The trap is mounted on a two-wheeled trailer. Mortality in this trap was only 20·7 per cent. when the cage was emptied early in the morning, before the temperature rose and humidity fell appreciably. Between 1st June and 1st August 1941, the trap was operated on 38 nights and caught 6,125 mosquitos. The New Jersey trap [**23** 151], modified by the addition of solidified carbon dioxide and the substitution of a cage for a killing jar, caught 4,359 mosquitos on 32 nights with a mortality rate of 36·2 per cent.

In the fifth paper, the results of various workers' experiments on the transmission of western equine encephalomyelitis by Arthropods are summarised, and evidence indicating that *Culex tarsalis* is the major vector of both this and St. Louis encephalitis in the Yakima Valley is brought forward [*cf.* **31** 19, 49]. It has not, however, been shown to transmit the equine virus. It is probable that there is a common vector for the two diseases, and when the paper was written there was no evidence that *Aëdes* could transmit St. Louis encephalitis. Experimental transmission of this virus by *A. lateralis*, Mg., is reported in a footnote. Biting activity of *C. tarsalis* was found to cease at the same time as the epidemic in 1941, although other mosquitos were still increasing in numbers. The epidemic curve fell off rapidly before the end of the hot season in 1939 and 1940. The seasonal activity of *Dermacentor andersoni*, Stiles, which transmits western equine encephalomyelitis experimentally [**29** 190], does not coincide with the epidemic period in most areas, and *Triatoma sanguisuga*, Lec., which harbours and transmits this virus [**29** 38], is not found in many areas where western equine encephalomyelitis occurs [*cf.* **30** 191]. Attempts to transmit the western virus with *T. rubida*, Uhl., failed. The part played by *C. tarsalis* outside the Yakima Valley must be judged on the basis of local observations.

SÚTTER (V. A.) & ZÚNIGA (H.). **A Malaria Survey of El Salvador, Central America.**—*Amer. J. trop. Med.* **22** no. 4 pp. 387–398, 4 maps, 11 refs. Baltimore, Md., 1942.

Data are given on the topography, geology, climate and population of Salvador, where a malaria survey, which occupied 129 days of field work, was made during 1938, 1939 and 1940. Differences between the relative prevalence of *Plasmodium falciparum*, *P. vivax* and *P. malariae* were not great, but the first two were significantly more common. The parasite index decreased as altitude increased, but the difference was not significant at less than about 2,000 ft. Malaria was endemic at all altitudes.

During the survey, Anopheline larvae were collected from ten localities and adults from four, at altitudes varying from some 16 to 2,145 ft. and with spleen indices varying from 9 to 93 per cent. Of the seven species taken, the only ones found everywhere were *Anopheles albimanus*, Wied., and *A. pseudopunctipennis*, Theo., which became, respectively, less and more prevalent as altitude increased. *A. albimanus* comprised 59 per cent. of the larvae of the two species taken in localities showing a spleen index above 25 per cent., and *A. pseudopunctipennis* 78·4 per cent. of those taken in localities with a lower spleen index. The salivary glands of 315 females of *A. albimanus*, 334 of *A. pseudopunctipennis* and 3 of *A. apicimacula*, D. & K., and the stomach and salivary glands of 35 females of *A. pseudopunctipennis* were dissected ; the only infection found was in two females of *A. albimanus*. Both these were from a town with a spleen index of 93 per cent. They gave a sporozoite rate of 0·87 per cent. for the locality.

KUMM (H. W.) & ZÚNIGA (H.). **The Mosquitoes of El Salvador.**—*Amer. J. trop. Med.* **22** no. 4 pp. 399–415, 2 maps, 9 refs. Baltimore, Md., 1942.

A mosquito survey of Salvador was made between July 1940 and February 1942 to complement the malaria survey [see preceding abstract]. The 58 species taken, the local distribution and breeding place or site of capture of adult of each of which is given, included 8 Anophelines, *viz.*, *Anopheles albimanus*, Wied., *A. apicimacula*, D. & K., *A. pseudopunctipennis*, Theo., *A. punctimacula*, D. & K., *A. argyritarsis*, R.-D., *A. eiseni*, Coq., *A. neomaculipalpus*, Curry, and *A. hectoris*, Giaquinto. The first three were recorded in an Anopheline survey of the Republic made in 1921 [*R.A.E.*, B **11** 167]. The species then identified as *A. strigimacula*, D. & K., is considered to be almost certainly the one now called *punctimacula*, and the material identified as *tarsimaculatus*, Goeldi, was probably composed of *A. argyritarsis* and *A. albimanus*. The authors did not find *A. aquasalis*, Curry, in Salvador, and, in Costa Rica and Panama, it is thought to occur on the Atlantic coast only [*cf.* **29** 181]. *A. albimanus* and *A. pseudopunctipennis* comprised, respectively, 65·4 and 33·6 per cent. of the 16,281 adult Anophelines taken and 47·4 and 38·4 per cent. of the 2,612 larvae. The latter was relatively much more abundant than it is in Costa Rica [**28** 220] or Panama, probably on account of the lower rainfall. It bred in the sun in ground pools and at the edge of slowly running streams and rivers, frequently where *Spirogyra* was present. *A. albimanus* bred for preference in sunny ditches or borrow pits, but also in seepage areas and among aquatic vegetation in quiet pools at the edges of streams, rivers and ponds, with or without *Spirogyra*. Although *A. albimanus* was the most abundant species, it occurred chiefly in the lowlands, whereas *A. pseudopunctipennis* was found at all elevations.

RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **On the swarming, mating, and ovipositing Behavior of** *Anopheles culicifacies*.—*Amer. J. trop. Med.* **22** no. 4 pp. 417–427, 3 figs., 14 refs. Baltimore, Md., 1942.

Efforts to induce adults of *Anopheles culicifacies*, Giles, to mate in a small cage (2×2×2 ft.) were unsuccessful, but swarming and pairing were observed in a large outdoor insectary in Pattukkottai, south-eastern Madras. The insectary consisted of a wire-screen cage (40×20×10 ft.) in which were a mud-thatch hut (10×8×8 ft.), a well, and two rows of borrow-pits for oviposition. A calf was tied in one compartment of the hut at night to provide food, and glucose solution and raisins were kept inside and outside the hut. Swarms of males occurred outside the hut in the evenings when light intensity fell below 2·0 foot-candles, females entered the swarms and copulating pairs flew away from them. It is not known whether swarming continues, or takes place again, after dark. Exact light conditions and a sufficient space for flying appeared to be essential for mating. The females that paired had usually taken a blood meal, and egg-development started before pairing. Noise did not disturb swarming and mating, but white objects and light invariably disturbed the swarms. There was no special relation with meteorological conditions, except that swarming did not take place during rain, or immediately before or after it. Phases of the moon had no effect. Mating seemed to occur when light was suitable, whether there had been a swarm or not.

Gravid females deposited eggs on the water surface while performing a "hovering" dance above it [*cf. R.A.E.*, B **28** 231]. They did not rest on the water surface, on floating matter or on the edge of the bank during this act. This is a new observation for Indian species and may explain the failure of *A. culicifacies* to oviposit in fields of growing rice [*cf.* **31** 62]. Direct light from a flashlight invariably caused the dancing females to fly away. Eggs were laid throughout the night, but mainly soon after it had become quite dark.

A. culicifacies produced several successive broods in the insectary, but the colony was not vigorous, probably on account of the heavy natural mortality of adults and the relatively small output from the few breeding places provided. Rapid development of ova in the ovaries was noticed, and eggs were laid in a few cases 48–72 hours after the first blood-meal [*cf.* **29** 5].

Knipe (F. W.) & Sitapathy (N. R.). **Notes on Improvements made to Equipment for Spray-killing of adult Mosquitoes.**—*Amer. J. trop. Med.* **22** no. 4 pp. 429–446, 10 figs., 8 refs. Baltimore, Md., 1942.

This paper on improvements in equipment for spraying houses to kill Anophelines as a measure for malaria control in rural areas of southern India [*cf. R.A.E.*, B **30** 168, etc.] includes notes on the structure of hand atomisers and on common defects found in them and sectional diagrams of two improved types, one with a fixed nozzle, designated the " Cobra," and one with an adjustable nozzle, known as the " Arrow." Both are light, strong, easy to operate and provide excellent atomisation within defined limits of droplet size. Descriptions are given of certain modifications in equipment in which the air-pressure in the tank is generated by means of a hand-pump, the type unanimously preferred by the operators, and the main features of a self-contained unit in which pressure is generated within the tank by means of solidified carbon dioxide [**30** 83] are summarised. Three different types of equipment with power-generated pressure, all depending on an internal combustion engine, were tested. The appliances and their operation are described, and modifications of them are discussed. The first consists of a high-pressure reservoir from which high-pressure knapsack-type tanks are filled ; the second is essentially a small commercial paint spray machine and can be operated by two men only ; and the third is a power-driven outfit that can be operated by one man, its weight being reduced to 30 lb. by using the exhaust gas to eliminate the need for an air compressor.

The improved hand atomisers, the equipment with the hand-pump and the first two types with power-generated pressure were tested for a period of five weeks during the 1941 malaria season. The efficiency of all was considered very satisfactory. The cost of operating the various types is shown in a table. The time and the quantity of insecticide required were least when the hand atomisers were used. It is believed that one or other of the types of equipment described is adaptable to practically any condition found in villages in southern India.

Knipe (F. W.) & Russell (P. F.). **Observations on the automatic Distribution of Paris Green.**—*Amer. J. trop. Med.* **22** no. 4 pp. 447–457, 4 figs., 7 refs. Baltimore, Md., 1942.

Field trials in the Philippines of a machine for the automatic application of Paris green dust to control Anopheline larvae [*R.A.E.*, B **22** 223 ; **26** 126] having indicated that it would be satisfactory, sample machines were taken to India, where modifications described in this paper were made. An improved design was thoroughly tested in irrigation canals, and proved effective for the control of larvae in slowly moving waters. The current effectively distributed a dust consisting of Paris green (2 per cent.) and charcoal over water 3 ft.deep and 20 ft. wide for 500 yards, provided that the velocity of the flow did not exceed 1·6 ft. per second. The effectiveness of the larvicide is apparently lost if it passes over a waterfall. The same machine was further modified to adapt it for the automatic application of a diluted emulsion of oil containing Paris green [**29** 112, etc.]. This necessitated a device to keep the emulsion sufficiently agitated to ensure even distribution. It was not so extensively tested as the dust-distributing machine, but showed promise.

Cambournac (F. J. C.). **Sôbre a epidemiologia do sezonismo em Portugal.** [On the Epidemiology of Malaria in Portugal.]—Demy 8vo, 235 [+3] pp., 4 figs., 4 maps (3 col.), 44 graphs (1 fldg.), 20 fldg. tables, 107 refs. Lisbon, the Author, 1942.

In this book, the author presents the results of detailed investigations in 1931–41 on Anophelines and malaria in Portugal. Little was previously known of the epidemiology of the disease there, though it is estimated that 70,000 cases occur annually. In the first chapter, he summarises the history of malaria in Portugal, and in the second describes morphological and biological peculiarities in Portuguese strains of *Plasmodium vivax*, *P. falciparum* and *P. malariae*. Details are given of the course of the disease in man, of the resistance of the parasites to drugs and of the numbers of gametocytes per 100 leucocytes in the peripheral blood necessary for a high percentage of females of *Anopheles maculipennis* var. *atroparvus*, van Thiel, to become infected. *P. vivax* completes its development in this mosquito in 10–12 days at the optimum of 24°C. [75·2°F.], and in 30 days at 16–17°C. [60·8–62·6°F.] ; increasing percentages of the oöcysts degenerate as the temperature falls below 20°C. [68°F.] or rises above 30°C. [86°F.]. The mosquitos remain infective for about six weeks after sporozoites appear in the salivary glands. The development of *P. falciparum* in the mosquito lasts 15 days at 24°C. and about 35 days at 19–20°C. [66·2–68°F.] ; it does not occur below 18°C. [64·4°F.], and some of the oöcysts degenerate at 21°C. [69·8°F.]. These differences in thermal requirements are reflected in geographical distribution. The development of *P. malariae* does not occur at temperatures below 16°C. and is shortest (25 days) at 24°C. Between 17 and 20°C. it lasts 35–45 days. *P. malariae* is always less abundant than the other two and appears most frequently at seasons when the mosquitos are sufficiently long-lived to enable its cycle to be completed in them.

In the third chapter it is stated that the species of *Anopheles* recorded from Portugal are *A. maculipennis*, Mg., *A. claviger*, Mg., and *A. plumbeus*, Edw. (*nigripes*, Staeg.), but the record of the last-named is based on a single individual taken in 1926 in a district in which malaria is not endemic. *A. claviger* occurs throughout Portugal and breeds in springs and ditches of clear cool water shaded by dense green vegetation. It is not found in dwellings and is apparently rare in animal quarters. The larvae overwinter and are scarce in summer, appearing chiefly in spring and autumn. Some adults also survive the winter. *A. claviger* was experimentally infected with malaria in the laboratory, but its habits render it unimportant as a vector in Portugal.

A. maculipennis is represented by vars. *typicus* and *atroparvus*, and the egg, larva and adults of each of them are briefly described. The distribution of var. *typicus* [*cf. R.A.E.*, B **26** 217] is limited to a belt of territory south of the Douro and north of Tomar. It breeds indiscriminately in ditches, pools and rice-fields, but its distribution within breeding places is irregular. The presence of *Myriophyllum verticillatum* is always associated with a predominance of var. *typicus* over var. *atroparvus*, although a few yards away from the plants over 95 per cent. of the eggs may be those of the latter. The water in which var. *typicus* breeds is clear, has little or no current, a pH of 6·5–7·5, a chloride content of 50–150 mg. per litre, a temperature of 15–25°C. [59–77°F.] and a negative bio-chemical oxygen demand ; it contains green vegetation and is exposed to direct sunshine during only part of the day. The optimum temperature for development is about 21°C. [69·8°F.]. Some sunshine, especially ultra-violet radiation, seems essential. The adults also require a moderate temperature, and the author considers this and a high relative humidity to be the factors governing the geographical distribution of this variety. It does not feed readily on man and is rare in dwellings, but comparatively abundant in animal quarters, particularly those occupied by cattle and pigs. It begins to breed a little later than *atroparvus*, oviposition being comparatively slight in

May and reaching a maximum in July and August; the eggs were deposited in batches of 400–450. Females with a well-developed fat-body appear in mid-September and seek winter quarters, such as hay lofts or store houses. In Portugal *typicus* does not occur in the absence of *atroparvus*; it may predominate locally, but examination of about 30,000 egg-batches shows that it generally constitutes only 10–15 per cent. of the *Anopheles* population. Although it may be responsible for occasional cases of malaria, its contacts with man are too infrequent for it to maintain even a slight endemic.

A. maculipennis var. *atroparvus*, of which the author considers vars. *fallax*, Roub., and *cambournaci*, Roub. & Treill. [**28** 119–120; **29** 41] to be synonyms, occurs throughout Portugal and maintains endemic and even hyperendemic malaria in many parts of the country. Its biology is described in great detail, but much of the information has been noticed from a briefer account [*cf.* **28** 117–119]. The chloride content in breeding water is now given as 50–150 mg. per litre. Ultra-violet radiation is necessary for producing strong, healthy adults. The optimum temperature of the water is about 25–28°C. [77–82·4°F.]. Mortality is increased at higher temperatures and development ceases at 37°C. [98·6°F.]. In the laboratory, the life-cycle lasted 25–35 days at 15–18°C. [59–64·4°F.], 18–19 days at 25–30°C. [77–86°F.], and 12–15 days at 34°C. [93·2°F.]. Below 15°C. development is very slow, but the larvae survive for several days at 4–5°C. [39·2–41°F.]. Females do not oviposit in water that contains more than 1 mg. sodium chloride per litre, but as larvae can develop in water containing up to 8 mg., those already present can complete their development in water that has become unacceptable for oviposition. Observations on swarming are recorded [**28** 120].

Other chapters deal with the geographical distribution of malaria in Portugal; the climatic distribution of malaria and environmental factors determining its endemicity; the effect of population factors on epidemiology; and the epidemiological types of the disease.

BRIGHENTI (D.). **Osservazioni biologiche sugli anofeli. Sull'***Anopheles* (*Myzomyia*) *pseudopictus*. [Biological Observations on *A. hyrcanus* var. *pseudopictus*.]—*Boll. Soc. ital. Biol. sper.* **27** no. 4 pp. 284–285. Naples, 1942.

The author describes white rings that he has observed on the antennal segments of examples of *Anopheles hyrcanus* var. *pseudopictus*, Grassi, taken by him in rice-fields and along the Adriatic coast in Italy. They have not previously been described in this variety, which he regards as a distinct species. He states that it differs from other Anophelines in the attitude in which it rests on walls, since its body is always extended at right angles to the surface. It is never found on the ceilings or upper part of the walls of houses and animal quarters, but only on the lower portions of the walls, not more than 5 ft. from the floor. It is negatively phototropic.

DE MAGALHÃES (O.). **Exanthematous Typhus of Brazil in Minas Geraes. Epidemiology.**—*J. trop. Med. Hyg.* **45** nos. 8–9 pp. 57–61, 65–69, 4 figs. London, 1942.

The author records the transmission of the causal organism of Brazilian exanthematic typhus [spotted fever] from a case in Minas Geraes to rhesus monkeys [*Macaca mulatta*] by the bites of *Cimex lectularius*, L. He concludes from a study of the epidemiology of the disease that the principal vector is *Amblyomma cayennense*, F. [*cf.* *R.A.E.*, B **27** 35, 36], which spreads it among the small mammals that form the natural reservoir and of which a list that includes the species already noticed [**27** 36] is given. It is thought that these animals bring the infection to the suburban areas when they come in search of food, and also that man and dogs carrying ticks act as accidental reservoirs,

bringing infection into the houses, where it is possibly spread among members of the household by *C. lectularius* [**23** 148; **27** 35, 36]. Clinical data in support of this are reviewed. Experiments showed that dogs fed on guineapigs that have died from the experimental disease may harbour rickettsiae in their blood for a short time, either showing no obvious symptoms or dying of an anomalous disease difficult to determine.

Spotted fever is never pandemic in Minas Geraes, but appears in well-localised centres, a list of which is given. Some centres remain quiescent for several successive years. One of the best known, Bello-Horizonte, is encircled by territory in which the disease occurs except for one zone where all grass is burned during the dry season, so that small mammals are driven out and ticks destroyed, and where there are no horses or cattle. There are, however, dogs in fair numbers and huts infested with a few bugs and ticks. Persons who visit the foci for hunting at the height of the epidemic season do not contract the disease. This may be due to the fact that they rid themselves of ectoparasites as soon as they can, whereas the inhabitants do not. Laboratory experiments indicated that a tick must feed on the host for 36 hours in order to transmit infection.

Travassos (J.) & Vallejo (A.). **Comportamento de alguns cavídeos** (*Cavia aperea* **e** *Hydrochoerus capybara*) **às inoculações experimentais do virus da febre maculosa. Possibilidade desses cavídeos representarem o papel de depositários transitórios do virus na natureza.** [The Behaviour of *C. aperea* and *H. capybara* to experimental Inoculation with the Virus of Spotted Fever. The Possibility of these Caviids being temporary Reservoirs of the Virus in Nature.]—*Mem. Inst. Butantan* **15** (1941) pp. 74–86, 5 graphs, 15 refs. São Paulo, 1942. (With a Summary in English.)

The rodents, *Cavia aperea* and *Hydrochoerus capybara*, which occur in several districts of São Paulo considered to be endemic foci of the São Paulo form of Brazilian spotted fever, were inoculated experimentally with strains obtained from man or from naturally infected examples of the tick, *Amblyomma striatum*, Koch, and maintained in guineapigs. *H. capybara* showed symptoms of a mild infection, but *C. aperea* was very sensitive and reacted in the same way as guineapigs. Natural infection could not be isolated from either species, but some examples of both caught in zones considered to be foci of the fever had presumably been infected, as they did not react to experimental inoculation. *H. capybara* is often infested by ticks, including *Amblyomma cooperi*, Nutt. & Warb., which is specific to it, *A. cayennense*, F., which is common, and *A. striatum*. The last two are regarded as vectors of spotted fever in Brazil, where they have been found naturally infected [*cf. R.A.E.*, B **26** 154; **27** 35, 36]. It is concluded that *C. aperea* and *H. capybara* are important in maintaining and spreading the infection among the tick vectors.

Travassos (J.) & Vallejo (A.). **Possibilidade de** *Amblyomma cajennense* **se infetar em** *Hydrochoerus capybara* **experimentalmente inoculado com o virus da febre maculosa.** [The Possibility of *A. cayennense* becoming infected from *H. capybara* experimentally inoculated with the Virus of Spotted Fever.]—*Mem. Inst. Butantan* **15** (1941) pp. 87–90, 1 graph, 1 ref. São Paulo, 1942. (With a Summary in English.)

In a further experiment [*cf.* preceding abstract], two examples of *Amblyomma cayennense*, F., that partly engorged on a capybara experimentally infected with São Paulo spotted fever transmitted the disease to a guineapig on which they were placed six days later. After four days on this guineapig, they were crushed and suspensions of them were inoculated into two others. One of these contracted the disease, and the other was subsequently shown to be immune.

The ticks belonged to a batch collected at a place where the disease had not been observed, and other members of the batch were shown to be free from natural infection.

DA FONSECA (F.) & CORRÊA (R. R.). **Infeção experimental de** *Anopheles (Kerteszia) cruzi* **pelo** *Plasmodium vivax.* [The experimental Infection of *A. cruzi* by *P. vivax.*]—*Mem. Inst. Butantan* **15** (1941) pp. 91–98, 1 pl., 6 refs. São Paulo, 1942. (With a Summary in English.)

Adults of *Anopheles cruzi*, D. & K., were bred from eggs laid by females taken in São Paulo. The males were dissected for identifying the species [*cf. R.A.E.*, B **26** 18], and the females were fed on patients carrying gametocytes of *Plasmodium vivax.* The salivary glands of 14 females and the stomachs of 25 were examined, and two were found to be infected, one in the glands and one in the stomach. The authors point out that this confirms Lutz's view, published in 1903, that malaria is transmitted by this Anopheline.

DA FONSECA (J. A. B.) & DA FONSECA (F.). *Leptomonas anophelini*, **sp. n., parasita do** *Anopheles eiseni.*—*Mem. Inst. Butantan* **15** (1941) pp. 101–102, 3 refs. São Paulo, 1942; also in *Arq. Hig. Saude públ.* **7** no. 15 pp. 9–10. São Paulo, 1942.

Records of the occurrence in mosquitos of flagellates of the genus *Herpetomonas* (*Leptomonas*) are reviewed. Their measurements are given and compared with those of numerous flagellates that were found in the intestine of a female of *Anopheles eiseni*, Coq., and for which the name *H.* (*L.*) *anophelini* is proposed. The mosquito in question had been reared from a larva taken near Santos in the State of São Paulo and had fed on a man and a guineapig. No flagellates were found in 29 other adults of *A. eiseni* of the same origin or in 351 of the so-called *tarsimaculatus* series [*cf. R.A.E.*, B **29** 177] of *Anopheles.*

DA FONSECA (F.). **Notas de acareologia. XXXII. Novas espécies brasileiras do gênero** *Liponissus* **Kolenati (Acari. Liponissidae).**—*Mem. Inst. Butantan* **15** (1941) pp. 103–118, 10 figs. São Paulo, 1942. (With a Summary in English.)

A list is given of the species of *Liponissus* recorded from Brazil, together with descriptions of *L. lutzi*, *L. monteiroi*, and *L. vitzthumi*, spp. n., from wild rats in São Paulo.

KUSCHER (A.). **Raubmilben beim Hund.** [Predacious Mites on Dog.]—*Wien. tierärztl. Mschr.* **27** pt. 1 pp. 10–16, 4 figs., 4 refs. Vienna, 1940. [Recd. 1943.]

Cheyletiella parasitivorax, Mégn., which was described from a rabbit on which it was preying upon *Listrophorus gibbus*, Pasquest, a parasitic mite that infests the fur of rabbits and hares, is the only Cheyletid that has been recorded from mammals. It was observed in Austria on a dog affected with mange due to *Demodex canis*, Leydig, on which it was predacious. Treatment with a preparation containing carbon bisulphide resulted in the disappearance of both mites.

PAPERS NOTICED BY TITLE ONLY.

CHORLEY (J. K.). **Tsetse Fly Operations, 1941. Short Survey of the Operations** [against *Glossina* spp. in S. Rhodesia] **by Districts for the Year ending December, 1941.**—*Rhod. agric. J.* **39** no. 4 pp. 231–235. Salisbury, S. Rhod., 1942. [Extract from Report of Division of Entomology: *R.A.E.*, B **31** 40.]

MUMFORD (E. P.). **Mosquitoes, Malaria and the War in the Pacific.**—*J. trop. Med. Hyg.* **45** no. 10 pp. 74–76, 26 refs. London, 1942. [*Cf. R.A.E.*, B **30** 185.]

Watkins (H. E.). **Scabies.**—*Brit. med. J.* no. 4282 p. 150. London, 1943.

An ointment that the author has used with complete success during 16 years' practice for the treatment of scabies [*Sarcoptes scabiei*, DeG.] consists of ½ oz. potassium hydroxide, ½ oz. sublimed sulphur, 394 grains vaseline, 394 grains wool fat, 49 grains zinc sulphate, 14 grains sodium hydroxide, 302 minims distilled water, 10 minims benzaldehyde and up to 4 oz. liquid paraffin. After a bath, the patient rubs the ointment over the whole body except the head and remains standing for 15 minutes. He then goes to bed for 24 hours, takes a second bath and puts on disinfected clothes. The single application almost always effected a cure.

MacHaffie (L. P.). **Pediculosis—a new Treatment.**—*Canad. Publ. Hlth J.* **32** no. 12 pp. 606–607. 1941. (Abstr. in *Exp. Sta. Rec.* **87** no. 3 p. 397. Washington, D.C., 1942.)

It is reported that C. R. Twinn has found a single treatment with a 15 per cent. solution of Lethane (*n*-butyl carbitol thiocyanate) in purified kerosene, applied by hand or as a fine spray, to be highly effective and inexpensive for the eradication of the head louse [*Pediculus humanus capitis*, DeG.], provided that the roots of the hair are well soaked [*cf. R.A.E.*, B **30** 99.]. It is suggested that a much weaker solution might be satisfactory, and that the replacement of part of the kerosene with olive oil would lessen any irritation that might occur.

Williams (F. X.). **The New Caledonian Cockroach Wasp** (*Ampulex compressa*) **in Hawaii.**—*Hawaii. Plant. Rec.* **46** no. 2 pp. 43–48, 6 figs. Honolulu, 1942.

An illustrated account is given of the habits of the Sphegid, *Ampulex compressa*, F., which was introduced into the Hawaiian Islands from New Caledonia in 1940 for the control of cockroaches and has apparently become established on Oahu. The female partially paralyses the cockroach and drags it into a hole before depositing an egg at the base of one leg ; it then seals the hole with débris. The larva feeds externally on the host for three or four days, and then internally until it pupates within the body of the host. The duration of the immature stages is 1–4 months or more and males that developed in captivity lived for a maximum of 85 days. Females lived for 31–159 days, and stored 20–88 cockroaches. *Periplaneta americana*, L., *P. australasiae*, F., and *Neostylopyga rhombifolia*, Stoll, are successfully attacked by *A. compressa*. More than 200 females have been liberated, chiefly in Honolulu, and the parasite is being sent to the other islands of the group.

de Zayas (F.). **Los Malófagos de las aves domésticas en Cuba.** [Mallophaga of domestic Birds in Cuba.]—*Mem. Soc. cubana Hist. nat.* **15** no. 2 pp. 201–209, 3 pls. Havana, 1941. [Recd. 1943.]

The species recorded include *Menopon gallinae*, L., *Eomenacanthus* (*M.*) *stramineus*, Nitzsch, *Lipeurus caponis*, L. (*variabilis*, Nitzsch) and *Goniocotes gigas*, Tasch., on fowls, *M. numidae*, Giebel, on guineafowls, *Goniodes pavonis*, L., on peacocks, *Virgula* (*G.*) *meleagridis*, L., and *L. gallipavonis*, Geoffr., on turkeys, *Columbicola columbae*, L., and *Goniocotes compar*, Nitzsch, on pigeons, and *Esthiopterum anseris*, L., on geese.

Parrot (L.). **Sur la nourriture des larves de phlébotomes.**—*Arch. Inst. Pasteur Algérie* **19** no. 4 p. 435. 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 9–10 p. 224. Paris, 1942.)

Larvae of *Phlebotomus sergenti*, Parr., *P. ariasi*, Tonnoir, and *P. parroti*, Adl. & Thdr., like those of other species of the same genus [*R.A.E.*, B **21** 21, 219], were found to feed readily, in captivity, on vegetable débris such as decaying leaves.

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S[ABIT] AKALIN (M.). **Anadolu Flebotomlarl. Ueber Phlebotomen in Anatolien.** [On *Phlebotomus* in Anatolia.]—*Türk. Z. Hyg. exp. Biol.* **2** no. 2 pp. 113–127. 1941. (Abstr. in *Bull. Inst. Pasteur* **40** no. 9–10 p. 224. Paris, 1942.)

Records are given of the occurrence in Anatolia of *Phlebotomus papatasii*, Scop., *P. sergenti*, Parr., *P. perniciosus*, Newst., and *P. minutus*, Rond.

PARROT (L.). **Notes sur les phlébotomes. XXXV. Présence de** *Phlebotomus perfiliewi* **dans la banlieue d'Alger.**—*Arch. Inst. Pasteur Algérie* **19** no. 3 pp. 360–361. 1941. **XXXVI. La femelle de** *Phlebotomus papatasi* **var.** *bergeroti* **Parr., 1934.**—*T. c.* no. 4 pp. 437–439.

PARROT (L.) & BODET (J. Y.). **XXXVII. Présence de** *Phlebotomus alexandri* **Sinton dans le Tassili des Ajjer (Sahara central).**—*T. c.* p. 440.

PARROT (L.) & PICHEYRE (R.). **XXXVIII. Phlébotomes du Hoggar.**—*T. c.* pp. 441–442. (Abstr. in *Bull. Inst. Pasteur* **40** no. 9–10 p. 225. Paris, 1942.)

Phlebotomus viduus, Parr., which was described from Abyssinia [*R.A.E.*, B **24** 160] is considered to be the female of *P. papatasii* var. *bergeroti*, Parr. [**23** 43]. *Phlebotomus perniciosus*, Newst., *P. sergenti*, Parr., *P. alexandri*, Sinton, *P. papatasii* var. *bergeroti* and *P. minutus* var. *signatipennis*, Newst., are now known to occur in the Hoggar.

HERTIG (M.). *Phlebotomus* **and Carrión's Disease. I. Introduction. II. Transmission Experiments with wild Sandflies. III. Field Studies on** *Phlebotomus*. **IV. Massive Infections of the Sandfly Proboscis with unidentified Microorganisms.**—*Amer. J. trop. Med.* **22** no. 4 Suppl. 75 pp., 9 pls., 1 map, 1 graph, 39 refs. Baltimore, Md., 1942.

The introductory section of this detailed account of the author's investigations in Peru since 1937 includes a note on the recent extension of the distribution of bartonellosis (Carrión's disease) [*R.A.E.*, B **30** 49] and a review of early ideas on the means by which it is transmitted, the discovery of the close correlation between its epidemiology and the distribution and habits of *Phlebotomus* [**17** 190, etc.], and the recovery of *Bartonella bacilliformis* from wild sandflies [**17** 155, 189]. Mention is also made of the author's preliminary unsuccessful transmission experiments and of infection of the sandfly intestine with a bartonella-like organism after feeding on persons showing bartonella in the blood [**26** 60]. It is now known that all the females that fed in these experiments were *P. verrucarum*, Tns.

The second section contains a report of transmission experiments in which females of *P. verrucarum* caught in the endemic zone of Peru were applied in feeding cages to the clipped abdomens of rhesus monkeys [*Macaca mulatta*] for 15–20 mins. Five out of eight monkeys in one series of tests begun in March 1938 became infected with *B. bacilliformis* [*cf.* **20** 124]. No skin lesions were produced, but infection was demonstrated in all cases by at least two positive blood cultures. The intervals between the first feedings and first positive cultures were 12–43 days and those between first and last positive cultures 8–29 days. Nodules from which *B. bacilliformis* was recovered were produced in several species of South American monkeys by intradermal inoculation of cultures, but blood cultures were negative, and feeding by sandflies and inoculation experiments with them gave negative results both as to the production of nodules and blood cultures. *P. verrucarum* was only slightly attracted to rhesus monkeys when given free access to them. The infection rate in wild sandflies is discussed. In the experiments of various workers in which *B. bacilliformis* was recovered from *Phlebotomus*, mostly from heavily infected centres, the minimum proportion of infected sandflies varied from 1 : 30, or possibly 1 : 18, to 1 : 220.

In the third section, which deals with field studies made over a period of more than four years, chiefly in the Rimac and Santa Eulalia valleys near Lima, the general characteristics of *Phlebotomus* are briefly discussed, the distribution and habits of the three species found are described at length, and the dates of collections are given, with details on the nature of the locality, incidence of bartonellosis there, types of daytime shelters and animal hosts. The breeding places, which must provide darkness, humidity and a supply of organic matter as food for the larvae, are very difficult to locate. In an extended search for immature stages, the author found only one empty pupal case. *Phlebotomus* can be easily reared in the laboratory. The egg, larval and pupal stages of the Peruvian species lasted 9–12 days, 4–6 weeks and 10 days, respectively, at a temperature of 23–25°C. [73·4–77°F.], and females usually oviposited 5–7 days after a blood-meal. The sandflies fed only at night with very rare exceptions, probably associated with temperatures below 18°C. [64·4°F.]. The lower limit of normal activity appeared to be about 13°C. [55·4°F.], but activity may be intense at 15°C. [59°F.]. It is estimated that in a heavily infested district, each person may be bitten by 20–50 sandflies each night. They can crawl up sleeves and trouser-legs and between the overlapping edges of leather puttees. They were successfully repelled by a mixture of 8 parts vaseline, 2 parts citronella oil, 1 part spirits of camphor and 1 part cedarwood oil, applied to exposed parts of the body at intervals of about an hour.

The following is taken from the author's summary of the distribution and habits of Peruvian species. *P. noguchii*, Shannon, was found throughout the endemic zone of both valleys at altitudes of more than 4,500 ft., but information for places with lower altitudes is lacking. A decrease in its abundance from August to October was noted in some places. It occurred typically in outdoor positions, such as excavations, usually in association with field-mice (principally *Phyllotis* spp.), which were the chief or possibly the only hosts. Where these nested or hid, 10–20 engorged females could sometimes be found at one time. In excavations unoccupied by animals, males greatly outnumbered females, the majority of which were unfed. *P. noguchii* is attracted to white mice and feeds on them if they are caged where it occurs in nature, but does not do so in the laboratory, where it also refused to bite any other hosts offered (which included man, monkeys, guineapigs, lizards and snakes) except the field-mice. It was not tested with birds, but engorged females were never found among catches from fowl pens. It rarely enters houses, and comprised less than 0·5 per cent. of several thousand individuals taken in buildings about 30 yards from a cave in which it was almost always to be found. It was very rare in pig-pens, stables or sleeping places of dogs in the open, and there is no evidence that it bites man or other large mammals. It apparently plays no part in the transmission of bartonellosis to man. *P. peruensis*, Shannon, was found chiefly in the upper part of the zone. It was extremely rare at altitudes of less than about 5,700 ft. and was taken once at 10,400 ft., well above the endemic zone. At one centre, it was represented chiefly by fed females caught in a cave with a dog, where it was outnumbered in the proportion of 30 : 1 by *P. verrucarum*. At another, in roadside cavities, males of *P. peruensis* were outnumbered in the proportion of about 100 : 1 by *P. noguchii*. At only two localities, one in each valley, was it taken in numbers approaching abundance, in houses and a cave occupied by a dog, respectively. During January and February 1939, it occurred at both these places in fair numbers, and at one of them was scarce in May and very rare in July, while *P. verrucarum* maintained its customary abundance. Collections from the same places in the early months of 1940 yielded only scattered individuals. The three species may all exhibit temporary variations in numbers, but this steady decline of *P. peruensis* with failure to regain its former abundance during the next season was the only long-term variation met with. Nucleated red cells were found in several females of this species. It feeds on man in the laboratory but less readily than *P. verrucarum*,

with which it is in general comparable in habits. The part it plays in the transmission of bartonellosis is not known, but it is clear from its distribution that it is not a factor in some of the best-known sites. *P. verrucarum* is usually abundant throughout the endemic zone in both valleys, and occurs also in the focus in the Department of Ancachs. No great seasonal variation was noted in its abundance. It enters houses freely, bites man, and is found associated with man and domestic animals both in buildings and in outdoor situations remote from dwellings. It feeds readily on large mammals in the laboratory, is not attracted to field-mice in nature and has refused to feed on them in captivity, and was not attracted to lizards [*cf.* **2** 144, 187]. It is the only species of *Phlebotomus* that can be completely correlated with the epidemiology of bartonellosis, as it is the only one that occurs throughout the zone, enters houses and bites man [*cf.* **27** 106].

The fourth section deals with the finding of over 300 massive infections of the tip of the proboscis of sandflies of both sexes with a minute bartonella-like organism, between January 1939 and December 1940. The proportion of infections was greatest in the rainy season, especially after January or February, and varied with locality. The percentages of infection found in *P. verrucarum*, *P. noguchii* and *P. peruensis* were 22·1, 1·4 and 22·5, respectively, in females, and 37·5, 5·1 and 14·3 in males. In many cases, the pharynx also was infected. The character of the infection was remarkably constant. Out of 372 uncontaminated cultures of the proboscis of *P. verrucarum*, *B. bacilliformis* was recovered in pure culture from the typically infected proboscis of each of two females, and an unnamed micro-organism of similar morphology but easily differentiated from *B. bacilliformis* was recovered in pure culture at least 30 times and from at least one proboscis in which the infection could not be detected by microscopic examination. In a separate series of experiments, the intestine of one female of *P. verrucarum*, out of 25 uncontaminated cultures, was positive for the unnamed organism. The proboscis of this sandfly was known to be infected, but the culture was contaminated. *B. bacilliformis* was recovered in pure culture from the intestine of each of three wild individuals of *P. verrucarum* that had fed about 60 hours previously, though the proboscis cultures of the same sandflies were negative. Artificial feeding of *P. verrucarum* on cultures of *P. bacilliformis* failed to produce comparable infections of the proboscis, while feeding on cultures of the unnamed organism gave only one typical infection in a number of trials, though infections of the pharynx nearly always resulted. The data are not sufficient to show the extent to which *Bartonella* enters into these infections, or whether they represent the mechanism of transmission of bartonellosis.

LOHMANN (R.). **Stand der Simuliidenforschung und Beitrag zur Immunitätsfrage.** [The present Position of Research on Simuliids and a Contribution to the Question of Immunity.]—Diss. Inst. Parasitol. vet.-med. Zool. Hannover, 1941. (Abstr. in *Dtsch. tierärztl. Wschr.* **50** no. 25–26 p. 274. Hanover, 1942.)

At least 15 species of Simuliids occur in the districts of the Leine and the Aller, in north-western Germany, and injury by them to cattle is greater in this region than in other parts of the country [*cf.* *R.A.E.*, B **20** 38]. On the Leine, *Simulium* (*Boophthora*) *sericatum*, Mg., is the most harmful species, while *S.* (*Odagmia*) *ornatum*, Mg., which occurs in the north of this district and on the Aller, is occasionally injurious. Mass emergence of adults was observed on warm dry days in April and May, and the females, but not the males, form swarms, which are sometimes carried for miles by wind. Mortality of cattle is due to the toxin injected by the Simuliids in feeding ; it occurs chiefly in young animals at pasture during their first or second summer, and is uncommon

in older ones. Repeated attacks sometimes apparently result in immunity, and in experiments guineapigs were immunized by repeated intraperitoneal injection of the toxin ; this immunity lasted for at least four weeks.

POTEMKINA (V. A.). **Contribution to the Biology of *Moniezia expansa* (Rudolphi, 1810), a Tapeworm parasitic in Sheep and Goats.**—*C. R. Acad. Sci. URSS* (N.S.) **30** no. 5 pp. 474–476, 2 figs., 6 refs. Moscow, 1941. [Recd. 1943.]

With a view to finding intermediate hosts of *Moniezia expansa* in the Russian Union, where *Galumna emarginata*, Banks [*cf. R.A.E.*, B **28** 135] does not occur, many thousands of Oribatid mites were collected in 1940 from moss, dead leaves and other soil débris near Moscow. The débris was placed on a piece of gauze over a funnel standing in a tumbler and exposed to illumination from above, which caused the mites to move downwards and drop into the tumbler. They were then kept in a saturated atmosphere at 19–21°C. [66·2–69·8°F.] in small containers with soil, moss, dry leaves and decaying wood, and were fed on eggs obtained from mature proglottids of *M. expansa* from the intestines of slaughtered sheep. They readily ingested the eggs, and subsequent dissection of about 1,000 of them showed that two species, *Galumna obvius*, Berl., and *Scheloribates laevigatus*, Koch, can serve as intermediate hosts of the tapeworm. The stages of development found after various intervals are described; many of the mites harboured cysticercoids with a mobile scolex after 70–77 days. *G. obvius* and *S. laevigatus* were also found to harbour cysticercoids of *M. benedeni* and *Thysaniezia ovilla* after being fed on eggs of these Cestodes.

[FEDINA (O. A.).] **Федина (О. А.). Observations sur la migration et le sort des puces dans les terriers inhabités de spermophiles.** [*In Russian.*]—*Rev. Microbiol.* **18** (1939) no. 3–4 pp. 308–319, 2 refs. Saratov, 1940. (With a Summary in French.) [Recd. 1943.]

Field observations on the migration of fleas from abandoned burrows of *Citellus pygmaeus* [*cf. R.A.E.*, B **27** 170] were continued in the Province of Ordzhonikidze (northern Caucasus) in February–June 1936, March–August 1937, and March–May 1938. Preliminary investigations showed that very few fleas overwintered in them and that more did so in those frequented by various small animals, such as voles and mice, than in those from which animals were excluded by covering the entrances with nets. It was found that the latter burrows rapidly collapsed, and no fleas were taken in burrows that became blocked by soil. Data on migration were obtained by removing ground squirrels from either winter or summer burrows and inserting traps [*loc. cit.*] or wads of cotton-wool [**24** 53] into the entrances. The traps caught more fleas from winter burrows than the wads, but fewer from summer ones. The wads, however, may have trapped fleas that were entering the burrows as well as those that were leaving them. The results are shown in a table and discussed in detail. About 90 per cent. of the fleas that migrated did so within a month. Migration began on the first day in a few cases and within 5 days from 56 per cent. of the burrows ; the maximum period preceding migration was 48 days. Migration continued for up to 40 days, and the numbers of migrating fleas taken averaged 15·3 per burrow. More fleas migrated at night than during the day, and more were taken migrating from summer burrows than from winter ones. About 62 per cent. of the fleas that migrated represented species that infest the host itself, of which *Ceratophyllus tesquorum*, Wagn., was by far the most numerous, while the others were species that inhabit the nests, mostly *Neopsylla setosa*, Wagn. [*cf.* **27** 170] ; of those that remained in the nests, *N. setosa* was in the majority. It is concluded that hunger is the chief factor inducing migration.

A variation of the trap designed to catch fleas that enter the burrows from outside was not successful, and it is suggested that material from the nest or droppings of ground squirrels should be substituted for the water, in order to attract the fleas.

MELLANBY (K.). **Scabies.**—Cr. 8vo, xi+81 pp., 2 pls., 7 figs. London, Humphrey Milford, Oxford Univ. Press, 1943. Price 5*s*.

This little book is intended to help those responsible for the treatment of scabies to diagnose it accurately and control it effectively. It is based mainly on the results of work carried out by the author during the past two years [*cf.* *R.A.E.*, B **29** 182; **30** 145]. The responsibility of *Sarcoptes scabiei*, DeG., for the condition is first demonstrated, the various stages of the mite are described and figured, and an account is given of its life-history, together with notes on the method of isolating it from a suspected case, the surest means of diagnosis. Information on the number of female mites usually concerned in a case and the sites where their burrows most frequently occur is given in the second chapter, and the third deals with symptoms and the sites of the follicular papules, which are probably caused by the activity of the immature stages, and of the rash, which do not correspond with the sites favoured for burrowing. Attention is also drawn to the existence of a period preceding sensitisation in persons infested for the first time, when no discomfort is felt. This period usually lasts about a month. Subsequent chapters deal with secondary infections, transmission, incidence (with particular reference to its present increase in Britain), prevention, and treatment of the infestation and the secondary infections. Thirteen treatments that have been popular against the infestation are reviewed, and their comparative effectiveness is shown in a table. Sulphur ointment, Marcussen's ointment (which contains a mixture of unstable polysulphides), dimethyl-diphenylene disulphide and benzyl benzoate all gave complete or almost complete kill of the mites, while the others were much inferior. The first and last are considered the most practicable, and effective methods of applying them are given, together with formulae for preparing Berlese's fluid and benzyl benzoate emulsions. The book concludes with brief reviews of conditions that may be confused with scabies and of mites other than *S. scabiei* that have medical importance.

TREILLARD (M.). *Anopheles hyrcanus* **en Provence; morphologie et biologie; gîtes et refuges.**—*Bull. Soc. Path. exot.* **35** no. 1–2 pp. 14–18, 12 refs. Paris, 1942.

While examining the edge of a marshy lake overgrown with reeds on a sunny afternoon about the end of July 1941, in the course of a survey of the mosquito fauna of Crau [*cf.* *R.A.E.*, B **31** 14], the author and his assistant were bitten by females of *Anopheles hyrcanus*, Pall., which were very aggressive, and collected adults and larvae of this species, which had only once previously been found in France [**9** 49], when the females bit only at dusk. The systematic position and varieties of this species are discussed, and its distinguishing characters are given. The adults collected are thought to belong to var. *pseudopictus*, Grassi, a view supported by the fact that they have not been taken in the many catches made in dwellings or animal sheds, since rural habits are characteristic of this variety and probably account for the slight importance attached to it as a malaria vector. The chief available sources of blood were sheep and wild birds and rodents. The principal resting-place of the adults appeared to be the reeds, and fourth-instar larvae were found among these. The adults were more difficult to maintain in captivity than *A. maculipennis*, Mg., or *A. claviger*, Mg. (*bifurcatus*, auct.), but were kept alive for several weeks by daily blood-meals on man. They were as aggressive in captivity as in nature.

Girard (G.). **Le comportement de la puce** *Synopsyllus fonquernii* **et son rôle dans la transmission de la peste.**—*Bull. Soc. Path. exot.* **35** no. 4–5 pp. 177–181. Paris, 1942.

The information in this paper on the prevalence and bionomics of *Synopsyllus fonquernii*, Wagn. & Roub., in Madagascar is based on observations made since 1934, and some of it has already been noticed [*R.A.E.*, B **25** 75 ; **26** 52]. After making a second study of material identified in 1925 [**14** 23], Roubaud confirmed that it did not include this species, although the rats had been caught both in summer and winter. Since 1934, thousands have been taken on *Mus* (*Rattus*) *rattus alexandrinus*, and none on hedgehogs or *Centetes* [*cf.* **21** 31] though many individuals were examined. It is possible, however, that their burrows may harbour it, as do outdoor burrows of the rat. At Tananarive in 1934, the numbers of *S. fonquernii* on rats for every 100 of *Xenopsyllus cheopis*, Roths., varied from 1 in February to 37 in September on rats taken indoors and from 3·2 in February to 138 in September on rats taken out of doors. In samples of dust from 98 houses in plague-infected villages between 9th December 1933 and 14th June 1934, 1,564 individuals of *X. cheopis* were found and only 31 of *S. fonquernii*, 25 of them in May and June. Comparable results were obtained between 1935 and 1940. *S. fonquernii* is now known to occur throughout the plateau region. Systematic examinations of the coastal zone have not yet been made. It has been shown to be capable of transmitting plague by biting, but as it is always associated with *X. cheopis* and is seldom found in houses, and plague spread over Madagascar when it was still very rare, its importance as a vector may not be great. On the other hand, it possibly plays a considerable part in maintaining the disease among rats, as those that live in the open are more numerous than those in houses and the relations between these rodents, which are all of the same species, are close.

Vinson (J.). **Une deuxième espèce de " mouche boeuf " à Maurice :** *Stomoxys calcitrans* **(Linné).**—*Rev. agric. Maurice* **21** no. 3 pp. 127–128, 1 pl., 5 refs. Port Louis, Mauritius, 1942.

Stomoxys calcitrans, L., has recently been found in Mauritius, where the only species of the genus previously known to occur was *S. nigra*, Macq. The differences in abdominal marking by which the two species may be distinguished are described.

Hesse (A. J.). **The Insect-food and Hymenopterous Parasites of the South African poisonous " Button Spider,"** *Latrodectus indistinctus* **Camb.**—*J. ent. Soc. sthrn Afr.* **5** pp. 45–63, 3 figs., 14 refs. Pretoria, 1942.

The remains of insects and other Arthropods discarded after feeding in 40 nests of *Latrodectus indistinctus*, P. Camb., collected in the wheat-growing areas [*cf. R.A.E.*, B **25** 151] of the western Cape Province and along the south coast are analysed. The spider does not display any powers of selection and the contents of the nests are considered representative of the ground fauna of their vicinity. The comparative frequency of *L. indistinctus* in or near cornfields appears to be related to the favourable conditions that these provide for such fauna. Hymenopterous parasites were found to have emerged in the field from egg sacs in five of the nests, and *Gelis* (*Pezomachus*) *latrodectiphagus*, sp. n., is described from ten males and seven females that emerged in the laboratory from one egg sac, and *Eurytoma arachnovora*, sp. n., from two males and 20 females that emerged from a second and one male and 21 females from a third. One of these also contained some dead or entrapped individuals, so that it must have supported at least 36 larvae, and the adults emerging from it were smaller than those that emerged from the other. An egg sac usually

contains 160–180 spider eggs. No others of the numerous egg sacs collected were parasitised. The bite of *L. indistinctus* has proved fatal to man on a number of occasions in South Africa.

De Meillon (B.). **New Siphonaptera from South Africa.**—*J. ent. Soc. sthrn Afr.* **5** pp. 83–87, 3 figs., 1 map. Pretoria, 1942.

Descriptions are given of adults of both sexes of *Chiastopsylla coraxis*, sp. n., from nests of *Myotomys unisulcatus* and a burrow of *Tatera brantsi* in Cape Province, and *Xenopsylla hipponax*, sp. n., from nests of *T. lobengulae* in the Transvaal and from Southern Rhodesia. The areas of distribution of *X. eridos*, Roths., *X. piriei*, Ingram, *T. brantsi* and *Desmodillus auricularis* in South Africa are shown on a map. It appears that *X. piriei* occurs chiefly in Cape Province and the southern part of the Orange Free State and that its commonest host is *D. auricularis*, and that *X. eridos* ranges over the central and northern part of the Orange Free State and southern Transvaal as a parasite of *T. brantsi*; there is some evidence that north of Onderstepoort it is replaced by *X. hipponax* occurring on *T. lobengulae*. The area in which *X. eridos* is most prevalent is that in which plague appears to be most firmly established [*cf. R.A.E.*, B **29** 66].

De Meillon (B.). **New Nematocera from the Ethiopian Region.**—*J. ent. Soc. sthrn Afr.* **5** pp. 87–98, 8 figs. Pretoria, 1942.

This paper includes descriptions of four new species of Ceratopogonids and of the pupa and adults of both sexes of *Simulium rhodesiense*, sp. n., all from Southern Rhodesia, and of the adults of both sexes of *Culex astridianus*, sp. n., and the adult female and male terminalia of *Anopheles vinckei*, sp. n., both from the Belgian Congo. Larvae of *A. vinckei* were found among vegetation in the Congo River. They cannot be separated from those of *A. cinctus*, Newst. & Cart., nor can the pupae be separated from those of *A. cinctus* or *A. dureni*, Edw.

Lewis (D. J.). **A northern Record of *Anopheles gambiae* Giles (Dipt. Culicidae).**—*Proc. R. ent. Soc. Lond.* (B) **11** pt. 9 pp. 141–142. London, 1942.

In May 1941, two males and four females of *Anopheles gambiae*, Giles, were bred from larvae collected in river pools about eight miles north of Wadi Halfa and a few miles south of the Egyptian frontier. The northernmost point from which this species had previously been recorded in the Ethiopian Region is Zeidab (17° 26′ N. lat.). In a paper already noticed [*R.A.E.*, B **22** 139], de Meillon discussed its distribution near its southern limit, in the Transvaal, and stated that it is present only in summer in the area with a range of temperature of between 41 and 45°F. and with 0–50 days of frost a year [*cf.* also **28** 24]. Wadi Halfa has 0–2 days of frost a year and a temperature range of 60·5° F., the difference between the mean maximum for June and the mean minimum for January (1902–1934).

Haddow (A. J.). **A Note on the predatory Larva of the Mosquito *Culex* (*Lutzia*) *tigripes* Grandpré & Charmoy (Diptera).**—*Proc. R. ent. Soc. Lond.* (A) **17** pt. 7–9 pp. 73–74, 1 ref. London, 1942.

During the early months of 1940, heavy rainfall at Kisumu, Kenya Colony, was accompanied by a marked increase in the numbers of *Anopheles gambiae*, Giles. It was noticed at this time that several borrow-pits that at first contained many larvae of *A. gambiae* later contained the predacious larvae of *Culex* (*Lutzia*) *tigripes*, Grp., exclusively. As it appeared almost certain that the latter had cleared the pits of the former, experiments were carried out to

determine how many they could eat in a short period. In each of a number of small bowls, 10 larvae of *C. tigripes* were kept for 15 hours overnight with 10 second-instar larvae, fourth-instar larvae or pupae of *A. gambiae.* In this time, they consumed 9–10 young larvae, 1–7 older larvae and 0–5 pupae, the means being 9·8, almost 5 and over 1. Direct observations were made on the method of feeding. The small number of pupae eaten was attributable to their highly chitinised integument and very powerful swimming movements, which usually enabled them to escape. Even in large jars and in the presence of Anophelines, the larvae of *C. tigripes* repeatedly attacked members of their own species, but the victim was usually able to get away. The main breeding-places of *C. tigripes* at Kisumu were muddy pools and borrow-pits frequented by *A. gambiae*, but the larvae were sometimes taken in reedy pools and swamps, breeding-places of *A. funestus*, Giles, *A. coustani*, Lay., and *A. pharoensis*, Theo., and several were found in a tree-hole together with two larvae of *Megarhinus* and many of *Aëdes* and *C. nebulosus*, Theo.

CHORLEY (T. W.) & HOPKINS (G. H. E.). **Activity of *Glossina pallidipes* at Night (Diptera).**—*Proc. R. ent. Soc. Lond.* (A) **17** pt. 7–9 pp. 93–97, 1 ref. London, 1942.

The observations here recorded provide some confirmation for Vanderplank's inference that *Glossina pallidipes*, Aust., feeds on moonlight nights and less freely, if at all, on dark nights [*R.A.E.*, B **30** 50]. The work was carried out 88 miles north of Kampala, Uganda, in a region that has recently become heavily infested with *G. pallidipes* so that an important cattle-trade route has become unusable. As it has frequently been stated that cattle can be safely taken through belts infested by *G. morsitans*, Westw., provided that the journey is made at night, it was considered desirable to determine whether this was true of *G. pallidipes*, though the partly crepuscular habits of this species gave small grounds for expecting a favourable result. The observations were made from 7·25 p.m. ($\frac{3}{4}$ hr. after sunset) until midnight on 8th–9th July 1941 and from midnight until 6·15 a.m. on 9th–10th, both cloudless nights with a full moon, and from 7·30 p.m. until 6·30 a.m. ($\frac{1}{2}$ hour after dawn) on 23rd–24th July, which was a moonless night with a starry sky until about 2.30, when it became overcast. They covered $2\frac{1}{2}$ miles of road running through samples of all the main vegetational types of the district. An ox was used as bait, and also, after the first night, a screen consisting of the dry skin of a hartebeest folded over a pole and carried so that the sides hung about six inches above the ground. On the moonlit nights, 25 males and 17 females were caught and a further 20 tsetses seen ; while in a similar daylight round during the time of maximum activity (4.30–6.30 p.m.) on 10th July, 15 males and 21 female were caught and a further 39 seen, in addition to a swarm that would not have been seen at night. Only one male and one female were caught on the dark night, the former when it was extremely dark, and two individuals, one of which fed full on the ox, were seen just after dawn. However, only seven individuals were seen between 4.30 and 6.45 on the preceding afternoon, so the figures for the nights are not strictly comparable. Most of the tsetses settled low down on ox, screen or man. Of ten caught or seen on the ox on the moonlight nights, at least four fed full, and a blood-filled male was taken on a man's leg at 5.50 a.m. There were indications that ox and screen were approximately equally attractive, while man was much less so.

HOPKINS (G. H. E.). **Modern Methods for the Control of Mosquitoes and Malaria.**—*E. Afr. agric. J.* **7** no. 4 pp. 212–219, **8** no. 1 pp. 42–46. Nairobi, 1942.

Measures for the control of Anopheline vectors of malaria are reviewed with particular reference to *Anopheles gambiae*, Giles, and *A. funestus*, Giles, the

chief vectors in East Africa, and to the author's experience in the application of some of them against these mosquitos in Uganda. They comprise personal protection, measures against adult mosquitos and " naturalistic " and artificial measures against larvae. The subjects dealt with under the first heading are the suitable situation of dwellings (which should be as far as possible from breeding places and, in the case of Europeans and Indians, from those of Africans), mosquito-proofing of houses (which is considered invaluable), bednets, mosquito-boots, and the use of a repellent, such as naphthalene and citronella oil in vaseline, for those particularly exposed to attack. Spraying the interior of houses in the evening after the mosquito doors have been shut is recommended against adults [*R.A.E.*, B **24** 77], and directions are given for preparing a suitable spray [*cf.* **30** 169].

The importance of knowing the breeding habits of the local vectors before undertaking naturalistic measures against the larvae is stressed. Those discussed are the organic pollution of water with green vegetation, the introduction of salt water (which must be used only when knowledge of the local conditions is thorough, and is useless against *A. gambiae* and *A. funestus*), keeping the water muddy (which is useless against *A. gambiae*), the introduction of larvivorous fish, such as *Gambusia* and *Lebistes*, and of certain plants, shading, the combined shading and drying of swamps by afforestation, which involves enough temporary drainage to enable the trees to become established [*cf.* **21** 130], and wave action and water flow. Few mosquitos can breed in water that is in constant agitation, and larvae in moving water usually shelter where the flow is obstructed. Knowledge of this principle was applied at Jinja to the control of *A. gambiae* and *A. funestus* breeding extensively for a distance of several miles along the edge of Lake Victoria, in hoof prints in water-logged ground on the shore side of a belt of papyrus and in floating débris on the lakeward side. Beginning in 1931, the papyrus and mudbanks were cut away and much of the material so obtained used to raise the bank well above lake level. A nearly straight shore line of firm steep banks exposed to wave-action resulted. The initial cost was fairly high, but expenditure on upkeep during the ensuing ten years has been negligible, and breeding along the whole completed stretch has been almost completely eliminated. The same method has recently been applied with complete success to a small lake in Kampala, where *A. funestus* bred extensively.

The artificial anti-larval methods are of two kinds, permanent and temporary. Into the first category fall the filling-in of man-made holes no longer required and of small natural hollows, and the draining of larger natural hollows and seepages, which should not be resorted to unless neither filling nor afforestation is practicable, as the ditches themselves may become breeding places unless they are cemented or underground. Temporary control is effected chiefly by larvicides, and is not approved of if money is available for more permanent measures. The only larvicides dealt with are oil, Paris green dust and cottonseed " tar " [**24** 273] mixed with kerosene (3 : 1). This is proposed as a substitute for oil, which is now difficult to obtain, as Paris green is not considered suitable under East African conditions. Its possible value was suggested by the observation that a stream into which it was discharged from a ginnery contained no larvae for a considerable distance below the outlet pipe. It has an objectionable smell, which may tend to deter ovipositing females. A large-scale experiment with it is in progress.

Lewis (E. A.). **Tsetse-flies and Development in Kenya Colony.**—*E. Afr. agric. J.* **7** no. 4 pp. 183–189, **8** nos. 1–2 pp. 9–14, 74–79 ; 1 fldg. map. Nairobi, 1942.

The distribution of the seven species of *Glossina* that occur in Kenya is given, with notes on the type of country in which each is found and their habits and

importance in the transmission of trypanosomes. It is estimated that over one-seventh of the colony is infested, most of this area being uninhabitable for the greater part of the year. The problem is mainly one of trypanosomiasis of stock; *Glossina palpalis*, R.-D., and *G. swynnertoni*, Aust., which transmit sleeping sickness also, are restricted to parts of the Masai and the Kavirondo reserves [*R.A.E.*, B **24** 103; **26** 26]. The fly-belts are zones of different dimensions, irregular in shape, with localities that are either fly-free or only seasonally infested. The tsetses have permanent haunts from which they spread when conditions outside are favourable, and to which they return in adverse seasons. The native populations and their stock move accordingly. There is evidence that the flies are becoming established in new country in several localities; the way in which their spread is aided by movements of cattle and by road and railway traffic is discussed. The distribution of the different species is closely allied to the problems related to increase of cultivation and stock and lack of opportunity to rest the land. The view that the fly is beneficial in protecting certain areas from erosion is disputed, as the common species inhabit valleys where conditions favour profitable cultivation. It is considered practicable to initiate a system of cultivation in the rich riverine belts that would be remunerative, relieve congestion on the impoverished soil of the steeper gradients, and encourage improved agriculture under attractive conditions. The breaking up of the thicket would destroy the habitat of the fly, and stock could be admitted as cultivation proceeded and clearings provided effective protection. Conditions in Kenya are more favourable to stock or mixed farming than to intensive cultivation. Timber, fuel and shelter trees could be planted as the tsetses receded.

The natives are acquainted with safe zones and the times when the fly retreats to sheltered haunts and leaves a route by which stock can cross the fly-belt with relatively little loss from trypanosomiasis. Slight improvements in these routes might provide safe passage for all stock, and subsidiary routes could perhaps be made. Most species of *Glossina* in Kenya are dependent on water to a greater or smaller degree; parts of nearly all the large rivers harbour one or more species, which also spread up the tributaries. *G. pallidipes*, Aust., *G. swynnertoni*, *G. brevipalpis*, Newst., and *G. austeni*, Newst., can establish themselves near isolated waterholes. Consequently, there is a heavy demand on other watering-places in fly-free areas, and bore-holes, tanks and dams form points from which radiate numerous deeply worn tracks liable to erosion. In certain areas, long stretches of river bank have been cleared of fly by the catching-out method and made available to man and animals. Some fly-infested valleys are poorly supplied with surface water, the river-beds having almost disappeared as a result of prolonged silting, and elimination of the fly might still leave the country uninhabitable because of the lack of water. Experience in the Lambwe Valley in South Kavirondo and a survey of the old native watering-places there indicate the need for following up the tsetse-fly control by the development of water supplies. To abandon the areas would mean the possible extension of fly-belts, invasion of new territory and possible loss of more watering-places. Various factors that have to be taken into account in adopting a comprehensives scheme for the control of tsetses and measures that have been tried or adopted in other parts of Africa are reviewed and discussed with reference to the problem in Kenya.

WOODHILL (A. R.). **A Comparison of Factors affecting the Development of three Species of Mosquitoes,** *Aëdes* (*Pseudoskusea*) *concolor* **Taylor,** *Aëdes* (*Stegomyia*) *aegypti* **Linnaeus and** *Culex* (*Culex*) *fatigans* **Wiedemann.**—*Proc. Linn. Soc. N.S.W.* **67** pt. 1–2 pp. 95–97, 5 refs. Sydney, 1942.

The experiments here recorded on the factors affecting the development of *Aëdes concolor*, Taylor, and *A. aegypti*, L., are in continuation of previous ones

on these species and *Culex fatigans*, Wied. [*R.A.E.*, B **25** 93; **27** 37; **30** 123, 124]. The larvae were supplied with the same food in all tests. Larvae of *A. aegypti*, hatched in distilled water and transferred within 12 hours to tap-water with a pH of 9·2–9·5, took rather longer to develop to the adult stage than others transferred to normal tap water (pH 6·8–7·2), but the percentage emergence was not affected, whereas it was considerably reduced and the developmental period was again somewhat lengthened in water with a pH of only 3·6–4·2. First-instar larvae of *A. concolor* placed in sea-water with a pH of 4·0–4·2 did not give rise to significantly less adults than others kept in normal sea water (pH 7·8–8·2), but the developmental period was considerably extended. First-instar larvae of *A. aegypti* developed normally to the adult stage in distilled water or diluted sea-water with 10 parts salts per thousand, but did not reach the fourth instar in water with 13 parts salts per thousand. Pupae of *A. aegypti*, transferred from tap water a few hours after pupation, were not affected in any way by salinities of 35 or 70 parts salts per thousand.

The paper concludes with a complete summary of the observations on the physiological differences between the three species, described in this and the four preceding papers. They show why *A. aegypti* and *C. fatigans* do not breed in the same type of water as *A. concolor*, but the factors that prevent *A. concolor* from breeding in freshwater pools or swamps or artificial containers are not yet apparent.

VISWANATHAN (D. K.). **The Assam Medical Research Society, Shillong. A Résumé of its Activities during 1931-41.**—vii+46 pp., 6 pls., 12 graphs. Calcutta, 1941. [Recd. 1943.]

This review of the activities of the Assam Medical Research Society at Shillong during the ten years following its inception deals almost exclusively with investigations on the control of malaria. Most of the results have already been noticed [*R.A.E.*, B **24** 79, 81; **25** 102; **29** 68–71; **30** 101, 104, 172]. In observations on the habits of *Anopheles minimus*, Theo., it was found that there was no evidence of ovarian development in females fed on raisins and water or of mating when both sexes were left in a cage. No spermatozoa were found in the spermathecae after as much as 49 days. Unfertilised females of this species and also of *A. maculatus*, Theo., exhibited ovarian development after blood meals [*cf.* **30** 171], and laid sterile eggs. After blood-meals and mating, ovarian development took place, spermatozoa were found in the spermathecae, and eggs were laid and hatched. Two and even three batches of fertile eggs were laid as a result of a single mating. After the first time, oviposition appeared to depend on another blood-meal rather than on mating. The maximum number of eggs laid by a single female was 118 in the case of *A. minimus* and 147 in that of *A. maculatus*. Examination of the seasonal infection of *A. minimus* with malaria parasites showed that in the whole series, the oöcyst and sporozoite rates were equal, but the latter were higher than the former from May to September, slightly lower in October and November, and much lower from December to March. This may be due to the prolonged cycle of sporogony in the cold weather, the shorter life of the adult mosquito or both. The epidemiological and entomological studies led to the conclusion that control should be carried out from January to June in areas of moderate to high endemicity and practically throughout the year in hyper-endemic ones [**24** 80]. Rice bran was tested as a larvicide [*cf.* **22** 141] by itself and as a diluent for Paris green. When it was used alone, its effect was slight and depended solely upon securing an unbroken surface film that cut off the air supply from the larvae. Road dust was a cheaper diluent for Paris green strewn by hand and the rice bran clogged a dust gun.

The review includes a list of the places surveyed by the Society in 1931–40 and a summary of control measures in various centres.

Horsfall (W. R.). **Breeding Habits of a Rice Field Mosquito.**—*J. econ. Ent.* **35** no. 4 pp. 478–482, 2 refs. Menasha, Wis., 1942.

Psorophora confinnis, Lynch (*columbiae*, D. & K.) is of minor importance in most parts of Arkansas, but is the dominant species of mosquito in the rice-growing areas, where it is numerous throughout the summer, causing great annoyance and at times doing considerable harm to livestock. It oviposits on moist soil and not on water, but the practice of allowing the water to drain from the rice-fields at least once during the growing season permits of oviposition among the rank vegetation, which provides optimum conditions. Heavily shaded soil receives more eggs than that less heavily shaded, as it remains humid longer. The slow drying of the soil permits the completion of embryonic development, which is prevented if the eggs are submerged or become dry within 4–5 days of being laid. Eggs containing developed embryos hatch in ½–24 hours after they are submerged, during the summer, and the aquatic stages may be completed in less than a week, so that there may be many generations each year if conditions are suitable. Weekly observations in 1940 and 1941 showed that larvae are not continuously present in the rice-fields, and are abundant only for a week or less immediately after flooding. However, small numbers were collected during the second or third weeks after flooding. Collections were largest in fields that had dried completely. The average larval population for each period of abundance was 6–20 per sq. ft. No larvae were ever observed in a plot kept continuously flooded. Ditches yielded only two-fifths as many larvae per 100 sq. ft. as the rice-fields; they occupy a much smaller area and most of them dry up in summer. Those that are permanently flooded usually contain fish that eat larvae washed in from elsewhere. Schwardt's conclusion that rice-fields are not important breeding places [*R.A.E.*, B **27** 257] was based on records that did not happen to coincide with the short periods when the larvae are abundant in them. In an experiment on the influence of ground cover, areas on which rice was growing had 60–80 larvae per sq. ft. whereas bare areas had only about four, but variations in the density of the rice plants within normal field limits had no apparent influence on the number of larvae that developed.

Goodhue (L. D.), Sullivan (W. N.) & Fales (J. H.). **The Effect of some organic Halides on the Housefly.**—*J. econ. Ent.* **35** no. 4 pp. 533–536, 1 fig., 3 refs. Menasha, Wis., 1942.

A description is given of a small glass chamber of 7 cu. ft. capacity used for testing aerosols produced by spraying insecticide solutions on a hot plate [*R.A.E.*, B **28** 239], together with results of the determination in it of the toxicities to the house-fly [*Musca domestica*, L.] of 39 organic halides applied in this way. They were tested at 0·33 lb. per cu. ft. and if a kill of 60 per cent. or over was obtained in 48 hours, at halved concentrations until the kill fell below this. The exposure period was 30 minutes. The three most complex compounds, 3-chloroacenaphthene, 2-chlorofluorene and 9-bromophenanthrene, gave 60 per cent. kill or over at 0·02 lb. per 1,000 cu. ft., but some, such as methyl bromide, were too volatile to form aerosols and therefore not effective, and others had various disagreeable properties. A chlorinated diphenyl gave over 60 per cent. kill at 0·4 lb. per 1,000 cu. ft., and the halogenated naphthalenes were toxic at higher concentrations.

CARPENTER (S. J.). **Mosquito Studies in Military Establishments in the Seventh Corps Area during 1941.**—*J. econ. Ent.* **35** no. 4 pp. 558–561, 1 graph. Menasha, Wis., 1942.

The results are given of mosquito surveys made by various methods in a camp in Arkansas between May and November 1941, together with summaries of the results of surveys in other military establishments in Arkansas and Missouri. A total of 31 species was taken at the first camp, 20 in the larval stage, 14 by hand collection in diurnal shelters, 7 while biting and 25 in New Jersey traps, which compared favourably with hand collection for measuring densities of adults of *Anopheles quadrimaculatus*, Say. This species and *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), *Aëdes vexans*, Mg., and *Psorophora confinnis*, Lynch (*columbiae*, D. & K.) were abundant enough to be a major problem. *Anopheles quadrimaculatus* was most numerous in September. The other Anophelines taken were *A. punctipennis*, Say, and *A. crucians*, Wied. At another camp in the same State, *A. punctipennis* was the dominant Anopheline. The number of species of mosquitos recorded from Arkansas was raised to 45 by the capture of single females of *A. pseudopunctipennis*, Theo., *Aëdes trivittatus*, Coq., and *A. grossbecki*, D. & K. The collections in Missouri yielded 20 species, including *Anopheles quadrimaculatus*, which was obtained in each of the three areas studied, and *A. punctipennis*.

MAIL (G. A.). **Lethal Temperatures for *Dermacentor andersoni* Stiles and Other Ticks in British Columbia.**—*J. econ. Ent.* **35** no. 4 pp. 562–564, 4 refs. Menasha, Wis., 1942.

Dermacentor andersoni, Stiles, occurs in large numbers in south-western Saskatchewan, southern Alberta and southern British Columbia east of the Coast Range, and is the most important North American tick from the point of view of disease transmission. Its life-cycle under unfavourable conditions may occupy three years, but little is known of the temperatures to which it is subjected during hibernation. The results of freezing-point determinations made by the thermocouple method of Robinson [*R.A.E.*, A **17** 310] on several scores of ticks collected in different parts of British Columbia are given in this paper. It is stated that freezing is lethal to *D. andersoni*, as none of the ticks recovered even though they were withdrawn from the cold chamber before the undercooling point had been reached. Most ticks had a freezing point between −10 and −14°C. [14 and 6·8°F.], but 10 from a district with particularly severe winters had an average freezing point of −22·7°C. [−8·86°F.]. Ticks in all stages of engorgement appeared to be less resistant than unfed ones, so that if any were brought out of hibernation by an unusually early spring and succeeded in engorging and dropping replete, most would probably be killed by a night with a temperature below −7°C. (19·4°F.). No figures are available for nymphs, but as they also hibernate, it is presumed that they are as resistant as adults, though engorged ones that dropped late in the autumn would presumably perish. Little is known of the hibernation quarters of *D. andersoni*, but two inches of snow would give protection against temperatures of −17·8°C. (0°F.) or lower [*cf.* A **20** 691], if they were under dead leaves and other litter or flat rocks or in rodent burrows. Engorged larvae that dropped from a rabbit on 26th July showed a remarkable resistance 10 days later, the freezing points of five batches ranging from −22·5 to −24°C. [−8·5 to −11·2°F.], and the freezing points of three batches of eggs were −28, −27 and −26°C. [−18·4, −16·6 and −14·8°F.], although both these stages are normally present only during spring and early summer. Macerated eggs froze at −8°C. [17·6°F.].

Ixodes ricinus californicus, Banks, from the coastal regions froze at a similar temperature to *D. andersoni*; moisture is apparently the limiting factor preventing the establishment of the former in the interior. *I. texanus*, Banks, which can withstand long periods of desiccation and fasting, had also high

resistance to cold when unfed, the average freezing point of six individuals being −23·2°C. [−9·76°F.], but engorged ones were no more resistant than those of the other two species. The average freezing point of five engorged individuals of *Haemaphysalis cinnabarina*, Koch, which normally overwinters in an engorged state, was −11·3°C. [11·66°F.]. The lethal high temperature for unfed individuals of *D. andersoni* was between 45 and 46·5°C. [113 and 115·7°F.] with an exposure period of 5 hours.

Dove (W. E.) & Simmons (S. W.). **Control of Stable fly, or " Dog Fly," Breeding in Shore Deposits of Bay Grasses.**—*J. econ. Ent.* **35** no. 4 pp. 582–589, 3 figs., 3 refs. Menasha, Wis., 1942.

Simmons (S. W.) & Dove (W. E.). **Creosote Oil with Water for Control of the Stablefly, or " Dog Fly," in Drifts of Marine Grasses.**—*T. c.* pp. 589–592, 3 refs.

The first paper deals with the use of creosote oil diluted in diesel oil (1 : 3 or 4) for spraying drifts of fermenting marine vegetation (*Halodule wrightii*, *Thalassia testudinum* and *Cymodocea manatorum*) in north-western Florida for the control of *Stomoxys calcitrans*, L. [*R.A.E.*, B **30** 196 ; **31** 18]. The observations recorded were made in the course of large-scale use of the oil in 1941. The liquid was applied at an average pressure of about 650 lb. at the sprayer, through 100–400 ft. of ½ in. high-pressure hose, and the spray machines were mounted on shallow-draft barges. Time and material were saved and better results obtained if deep deposits were scattered with pitchforks before being sprayed. Between 4th September and 20th October, eight spraying units applied 208,350 U.S. gals. spray to drifts averaging 31·3 ins. wide and 7·6 ins. deep for some 286 miles. The cost is discussed. Eggs were commonly found at the rate of 1,000 per sq. ft. of untreated deposit and larvae at an average rate of 15·4 per sq. ft., and an average of 25·7 flies per cu. ft. of untreated material emerged in three field cages. No live larvae were ever found in treated material previously heavily infested with eggs, and substantially complete kill of larvae was obtained in large-scale tests when treatment was thorough. No living larvae were found in any deposits treated in 1941. These results were confirmed in tests on infested ground-nut litter [**30** 61] and celery strippings [**30** 196]. There was little opportunity for observation of pupal mortality, as most of the material was sprayed before pupation had occurred, but kill of this stage also appeared to be complete when treatment was thorough. Treatment of green uninfested weed prevented breeding. The creosote was found to remain in the weed for 18–30 days, or long after the stage of fermentation allowing of breeding was passed, and it withstood strong tidal action. Data are given on populations of *S. calcitrans* on various dates in different treated and untreated areas. The large-scale operations reduced the population in the former to less than two flies per cow, and residents agreed that 1941 was the first year in which the flies had not been present in outbreak numbers. However, the extremities of the treated area received some flies from adjacent untreated ones, and it is recommended that treatment should in future be carried at least 50 miles beyond the places to be protected. Three species of dragonflies, which were most abundant during October, were observed to catch and feed on adults of *S. calcitrans*.

In the second paper, an account is given of tests carried out in 1941 with 17,750 U.S. gals. emulsion on 14·07 miles of drifts, which showed that a mechanically prepared emulsion of creosote oil and water (1 : 3) can be successfully substituted for the mixture of creosote oil and diesel oil. The water was obtained from the bays or inlets, and the agitators in the sprayer maintained a satisfactory emulsion without the use of an emulsifier. Penetration appeared to be even better than that of the oil mixture when the weed was wet. Coverage remained effective for at least a month and withstood tidal action, and treated

deposits did not support subsequent breeding. The saving effected by the reduction in cost of materials and transport and in operating time was considerable.

Gregson (J. D.). **Notes on the Laboratory Rearing of some Canadian Ticks (Acarina).**—*Proc. ent. Soc. B. C.* **39** pp. 32–35, 6 refs. Vernon, B.C., 1942.

Notes are given on the methods used for rearing ticks at the Kamloops laboratory, British Columbia. One of the most important factors was found to be humidity, which has to be very high for practically all Ixodids. It is usually adequate while the ticks are feeding, though even so it is advisable for the hosts to be in a fairly humid atmosphere. At other times, the ticks should be kept in a cool cellar in open-ended glass tubes over damp soil, but they must be kept free of condensed moisture as they drown readily. While all longevity tests are carried out in a cellar with a temperature of 18°C. [64·4°F.] and a relative humidity of 100 per cent., it has been determined that the best method for increasing the length of life of ticks beyond the normal is to store them at 5°C. [41°F.] in boxes in a sealed jar containing damp absorbent cotton. Notes are given on the length of the combined preoviposition and incubation periods of *Ixodes ricinus californicus*, Banks, at these temperatures, and on the natural hosts of species of *Dermacentor*, *Ixodes* and *Haemaphysalis* and those on which they can be reared. *D. andersoni*, Stiles, feeds readily on nearly all laboratory animals. *I. r. californicus* is extremely difficult to rear and sensitive to desiccation, but *I. texanus*, Banks, is not, and feeds readily in all stages on members of the ferret family and in the adult stage on dogs and sheep. Polecats are the best laboratory hosts, though they may build up temporary immunity after infestation [*R.A.E.*, B **30** 156]. This tick is parasitised by *Hunterellus hookeri*, How., and may prove to be a good laboratory host for it, if it is cultured for the control of *I. r. californicus*. No Argasids have yet been reared in the laboratory, but several species have been recorded from British Columbia, including *Ornithodoros megnini*, Dugès, a pest of cattle, the adults of which do not feed. Since the larvae and nymphs stay on the host and may feed for over 3 months, it is doubtful whether any artificial method of feeding can be used in laboratory rearing.

Papers noticed by Title only.

Lewis (D. J.). **A new Species of** *Aëdes* [*eritreae*] **(Dipt., Culicidae) from Eritrea.**—*Proc. R. ent. Soc. Lond.* (B) **11** pt. 11 pp. 165–166, 1 fig. London, 1942.

Lane (J.) & Cerqueira (N. L.). **Os Sabetíneos da América (Diptera, Culicidae).** [Revision of American Sabethinae, including new subgenera and species.] —*Arq. Zool. S. Paulo* **3** art. 9 pp. 473–849, 76 pls., 13 refs. São Paulo, 1942.

Bonnell (D. E.) & Mote (D. C.). **Biology of the Klamath Midge,** *Chironomus utahensis* **(Diptera, Chironomidae)** [in Oregon].—*Proc. ent. Soc. B. C.* **39** pp. 3–7, 8 refs. Vernon, B.C., 1942. [For briefer account see *R.A.E.*, B **30** 45.]

Bashkirova (E. Ya.). **Contribution to the Study of the Biology** [Oribatid hosts] **of the Tapeworm** *Anoplocephala perfoliata* **(Goeze, 1782), parasitic in the Horse.**—*C. R. Acad. Sci. URSS* (N. S.) **30** no. 6 pp. 576–578, 2 figs., 6 refs. Moscow, 1941. [Recd. 1943.] [For fuller account see *R.A.E.*, B **30** 141.]

Kozhanchikov (I. V.). **On the Conditions of gaseous Metabolism in some** *Ornithodorus* **Species (Argasidae, Acarina).**—*C. R. Acad. Sci. URSS* (N. S.) **32** no. 7 pp. 515–518, 1 graph, 3 refs. Moscow, 1941. [Recd. 1943.]

Colas-Belcour (J.) & Grenier (P.). **Sur un ixodiné peu connu,** *Ixodes lunatus* **Neumann 1907, ectoparasite des rats malgaches.**—*Bull. Soc. Path. exot.* **35** no. 1–2 pp. 54–65, 5 figs., 10 refs. Paris, 1942.

Ejercito (A.). **Field Experiment on an Automatic Siphon Sluice in Malaria Control. (Design III.)**—*Acta med. philipp.* **3** no. 1 pp. 129–136, 5 pls., 7 refs. Manila, 1941. [Recd. 1943.]

The automatic siphon designed to flush large streams for the control of Anopheline larvae in the Philippines [*R.A.E.*, B **29** 169] did not work well in the wet season when the water was flowing rapidly and carrying débris with it. Under normal conditions, siphonage is terminated when the water level above the dam is low enough to uncover the inlet of the small auxiliary siphon, as the air admitted through it forms an air lock in the bend of the main siphon. If, however, the inlet is blocked by débris or covered so quickly by the rising water that it does not admit the full amount of air necessary, siphonage is continuous, the water level above the dam is kept approximately constant and the stream below is not effectively flushed. It was found that this difficulty could be met by making the other end of the auxiliary siphon discharge at a level approximately the same as that to which the water above the dam will fall, as it will then admit the necessary air.

This principle is applied in a modified design described in this paper, but it also eliminates the inlet arm of the auxiliary siphon and so avoids all clogging difficulties connected with it. The auxiliary siphon is inside the main one and consists merely of a horizontal pipe that passes through the dam close to the top to connect with a pipe that extends vertically from the top of the main siphon to about the level of its entrance and then horizontally to open through its down-stream wall.

Noé (J.) & Neghme (A.). **Contribución al conocimiento de la epidemiologia malarica en la provincia de Tarapaca. III. Comunicación: Quebrada de Vitor (Codpa-Chaca).** [Contribution to the Knowledge of the Epidemiology of Malaria in the Province of Tarapaca. III. Vitor Valley (Codpa-Chaca).] —*Rev. Chil. Hig. Med. prev.* **3** no. 3 pp. 199–230, 13 pls., 2 fldg. maps. 1940. (Abstr. in *Trop. Dis. Bull.* **39** no. 7 p. 427. London, 1942.)

In the course of the survey of this area in Chile, the only Anopheline present was *Anopheles pseudopunctipennis*, Theo., of which 697 females were dissected and 6 found to harbour oöcysts.

Aitken (T. H. G.). **Contributions toward a Knowledge of the Insect Fauna of Lower California. No. 6. Diptera: Culicidae.**—*Proc. Calif. Acad. Sci.* (4) **24** no. 6 pp. 161–170. [San Francisco, Calif.] 1942.

This account of the mosquitos of Lower California comprises records of three species of *Culex*, four of *Aëdes* and *Anopheles maculipennis freeborni*, Aitken, *A. pseudopunctipennis*, Theo., and *A. p. franciscanus*, McCracken. The typical *A. pseudopunctipennis* is the only Anopheline that has been collected in the town of San José del Cabo, where malaria is known to be present.

Bellamy (R. E.). **Observations on the macroscopic Species-identification of larval** *Anopheles* **in Georgia.**—*J. Parasit.* **28** no. 4 pp. 299–310, 6 refs. Lancaster, Pa., 1942.

Details are given of characters by which a great majority of living and uninjured fourth-instar larvae of Anophelines from southern Georgia can be macroscopically identified as *Anopheles quadrimaculatus*, Say, *A. crucians*, Wied., or *A. punctipennis*, Say, with only a small percentage of error, the remainder being attributed to one or other of two groups that require microscopic examination for identification. No provision is made for the identification of species that occur only in breeding places of special types. Macroscopic identification of third-instar larvae and pupae was attempted, with fair success in the case of the larvae but a large error in the case of the pupae.

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TATE (H. D.) & WIRTH (W. W.). **Notes on Mosquitoes in Nebraska (Diptera: Culicidae).**—*Ent. News* **53** no. 8 pp. 211–215, 3 refs. Philadelphia, Pa., 1942.

A list, including 21 species, is given of the mosquitos represented in the collection of the Department of Entomology, University of Nebraska, showing the localities in the State in which the various specimens were taken and the approximate date of collection. Reference is made to a few records in the literature of mosquitos in this State, but most of the species are recorded from it for the first time. Encephalitis has recently attained epidemic proportions in Nebraska.

RUHLAND (H. H.) & HUDDLESON (I. F.). **The Rôle of one Species of Cockroach and several Species of Flies in the Dissemination of** *Brucella*.—*Amer. J. vet. Res.* **2** no. 5 pp. 371–372, 1 ref. Chicago, Ill., 1941. [Recd. 1943.]

In an attempt to determine whether sudden outbreaks of brucellosis in previously uninfected herds of cattle in the United States could be explained by insect transmission, experiments were carried out in which *Periplaneta americana*, L., *Musca domestica*, L., *Muscina stabulans*, Fall., *Stomoxys calcitrans*, L., *Calliphora* and *Lucilia*, which are often found in and around dairy barns and feed on the excretions of animals, were allowed to feed freely for two hours on the growth of a virulent strain of *Brucella abortus* on solid medium. Culture media were streaked with the intestinal contents of the cockroaches or with droplets squeezed from the anus of the flies at intervals up to 168 and 96 hours, respectively, from the time of exposure. The results showed that *B. abortus* does not remain alive in the intestinal tract of the cockroach for more than 24 hours, and only a few colonies were obtained from the individuals that were positive. All cultures from fly excreta were positive, and in nearly all there were many colonies. The amount of growth obtained was heavier and it was freer from contamination 48 hours after exposure than earlier. It is concluded that flies must be considered as a possible means of transmitting brucellosis from animal to animal and from animal to man, and that every effort should be made to prevent them from feeding on infective materials.

JONES (H. A.) & SULLIVAN (W. N.). *Tephrosia* **Extract against House Flies.**—*Soap* **18** no. 9 pp. 94–95, 5 refs. New York, N.Y., 1942.

In view of the present difficulty in obtaining supplies of derris and cubé in the United States, the toxicity to house-flies [*Musca domestica*, L.] of kerosene extracts of recently developed strains of *Tephrosia virginiana* was studied in experiments in which four samples of *T. virginiana*, three of cubé and two of derris were compared. The extracts were prepared by steeping 6 gm. samples of roots in a flask with 50 cc. purified kerosene (approximately 1 lb. to 1 U.S. gal.) for about a week. The marc was similarly extracted with 50 cc. of a mixture of equal parts of acetone and kerosene. Both extracts were tested against house-flies by the turntable method [*R.A.E.*, B **26** 246], using the official test insecticide as a control. The results with the kerosene extracts are expressed as the averages of four tests with about 150 flies each and those with the extracts of the marc with one exception as the averages of two tests with about 150 flies each. Kerosene extracts of *Tephrosia*, cubé and derris gave 50–69, 66–81 and 72–77 per cent. kill in 48 hours, respectively, and 76–89, 88–96 and 95–98 per cent. in 72 hours, and acetone and kerosene extracts of the marc gave 96–100, 99–100 and 99 per cent. in 48 hours and 98–100, 100 and 100 per cent. in 72 hours. The results with the kerosene extracts were not comparable with those obtained with the extracts of the marc; the official test insecticide gave 24 and 25 per cent. mortality in 48 and 72 hours in comparison with the former and 50 and 53 per cent. in comparison with the latter. The effectiveness of

extracts of all the samples of *Tephrosia*, even though their total chloroform extract content was lower than that of derris or cubé, indicates that this plant should provide a suitable substitute for use in fly-sprays. The high toxicity of an extract of a sample of cubé of comparatively low rotenone and total-extract content and a high Goodhue red colour value emphasises the importance of constituents other than rotenone in accounting for the toxicity of some samples. A derris root with low content of rotenone and red-colour-forming compounds, but high in total extractives, gave a kerosene extract of high toxicity. This may be accounted for by its toxicarol content. The high kills obtained suggest that for practical use the proportion of root to solvent could be reduced.

Haller (H. L.), McGovran (E. R.), Goodhue (L. D.) & Sullivan (W. N.). **The synergistic Action of Sesamin with Pyrethrum Insecticides.**—*J. organic Chem.* **7** no. 2 pp. 183–184, 5 refs. Baltimore, Md., 1942.

Haller (H. L.), LaForge (F. B.) & Sullivan (W. N.). **Some Compounds related to Sesamin: their Structures and their synergistic Effect with Pyrethrum Insecticides.**—*T.c.* pp. 185–188, 11 refs.

These papers provide a more detailed account than the one already noticed [*R.A.E.*, B **31** 8] of experiments carried out to determine the synergistic effect of fractions of sesame oil on extracts of pyrethrum in refined kerosene against the house-fly [*Musca domestica*, L.], and to compare the synergistic action of sesamin and a number of similar compounds, the chemical relationship of which is discussed.

LaForge (F. B.), Haller (H. L.) & Sullivan (W. N.). **The Presence of an insecticidal Principle in the Bark of Southern Prickly Ash.**—*J. Amer. chem. Soc.* **64** p. 187, 2 refs. Easton, Pa., 1942.

The authors report that in the course of preparing asarinin [*cf.* *R.A.E.*, B **31** 8], it was found that a petroleum ether extract of the bark of *Zanthoxylum clava-herculis* also contained a substance highly toxic to the house-fly [*Musca domestica*, L.]. This product, which is a complex mixture apparently similar to pyrethrum in its toxic action on flies, was extracted from the hydrocarbon solution with 90 per cent. acetic acid; the acetic acid was then removed, together with water-soluble substances, by distillation under reduced pressure and washing the ethereal solution of the extractives, and the insecticidal material was further purified by hot extraction of the concentrate with ligroin and removal of the solvent.

Manis (H. C.), Dugas (A. L.) & Fox (I.). **Toxicity of Paradichlorobenzene to Third-instar Larvae of the Housefly.**—*J. econ. Ent.* **35** no. 5 pp. 662–664, 1 fig., 4 refs. Menasha, Wis., 1942.

The findings of previous workers on the toxicity of paradichlorobenzene to fly larvae are reviewed [*R.A.E.*, B **3** 192; **25** 110], and an account is given of tests on third-instar larvae of *Musca domestica*, L., under laboratory conditions. The larvae, which had been reared at 30°C. [86°F.] in a standard medium, were placed in batches of 10 in jars containing 40 gm. of the medium, with which paradichlorobenzene was mixed at rates of 99·9, 149·8, 249·4, 497·5, 744·4, 990·1 or 1234·6 mg. per 100 gm. treated food. Either 180 or 240 larvae were exposed to each concentration, and 0, 5·22, 14·72, 54·86, 84·91, 95·43 and 100 per cent., respectively, were killed, the remainder pupating successfully. The median lethal concentration is calculated from these results, excluding the 0 and 100 per cent. kills, to be 430·5 mg. per 100 gm. treated food. In a few

practical tests, in which paradichlorobenzene at rates equivalent to 497·5 and 1234·6 mg. per 100 gm. was applied as a layer over the contents of open and closed garbage pails, complete mortality was obtained in all cases. Such high mortality would probably not occur in open piles of manure or garbage. Toxicity was apparently due to combined action as a fumigant and stomach poison.

Gahan (J. B.). **The Compound, 4, 6-dinitro-o-cresol as a Cockroach Poison.**—*J. econ. Ent.* **35** no. 5 pp. 669–673, 18 refs. Menasha, Wis., 1942.

Preliminary tests in battery jars showed that the compound designated 3, 5-dinitro-o-cresol if the methyl group is given position 1 in the ring or 4, 6-dinitro-o-cresol if the hydroxyl group is given this position was highly toxic to *Periplaneta americana*, L. Further experiments were therefore made in which the cockroaches were confined in batches of 10 in small pens on sheets of waxed paper across which 1 gm. of a dust composed of this cresol, sodium fluoride or pyrethrum containing 0·33 per cent. pyrethrin I and 0·38 per cent. pyrethrin II, undiluted or mixed with talc at various concentrations, was spread in a band one inch wide. The cresol at 5 per cent. was more toxic than pyrethrum at the same concentration or sodium fluoride at 50 per cent., the percentages killed after 72 hours being 96, 64 and 88, respectively. Its toxicity decreased rapidly at lower concentrations, but even at 1 per cent. a 44 per cent. kill was obtained, whereas pyrethrum gave no kill at less than 5 per cent. The cresol caused complete mortality at 10 per cent., as did pyrethrum at the same concentration and undiluted sodium fluoride. Pyrethrum and sodium fluoride caused very little mortality in less than 12 hours, but the higher concentrations of the cresol caused 90–100 per cent. mortality in 3 hours. Its toxicity in a 10 per cent. dust was not reduced by exposure to the air in a room for 7 days. In tests in which the dust was applied to the bodies of last-instar nymphs fastened in open-ended tubes with rubber collars to prevent its ingestion, the cresol at 25 per cent. concentration was shown to be a powerful contact poison, while pyrethrum and sodium fluoride were also effective at this concentration, but much slower in action. These three substances gave complete mortality in 2, 16 and 16 hours, respectively, while insects dusted with talc alone died in 48–72 hours and untreated ones were alive when the collars were removed at the end of a week. Talc and redwood-bark flour were found to be the best of seven materials tested as diluents, the others either retarding the action of the poison or clogging the distributor. The cost in 1941 of a dust composed of 10 per cent. dinitro-o-cresol and 90 per cent. talc is given. Its use may be limited by the fact that it is toxic to domestic animals and has a tendency to stain.

Simmons (S. W.) & Dove (W. E.). **Waste Celery as a Breeding Medium for the Stablefly or " Dog Fly," with Suggestions for Control.**—*J. econ. Ent.* **35** no. 5 pp. 709–715, 2 figs., 1 ref. Menasha, Wis., 1942.

Severe localised outbreaks of *Stomoxys calcitrans*, L., in Florida in April, May and June 1941, were found to result from dense breeding in waste celery strippings deposited near washing establishments [*R.A.E.*, B **30** 196]. The five principal celery-growing areas in Florida total some 8,350 acres, and more than 1,000 loads of waste (each measuring 1½–2¼ cu. yards) are probably hauled away from the washing establishments in a day or 120,000 loads in the processing season (December–May). The piles may later be levelled and ploughed in, but this is usually done, if at all, when the waste is already heavily infested with larvae and pupae, and development continues in the soil [*cf.* **30** 61]. Even where uninfested strippings are ploughed in, the depth of soil covering them is seldom sufficient to prevent heavy infestation. One cage

covering 36 sq. ft. of strippings that had been ploughed in caught 11,700 flies in 5 days ; 11,653 of them were *S. calcitrans*. Often no ploughing is done and the accumulations attain a depth of 5 ft. They shrink to about one-ninth of their original volume in approximately two weeks and when they lose most of their water, fermentation results in heavy infestations. The number of adults of *Stomoxys* that emerged from a sample of the shrunken strippings in a fortnight was equivalent to a production of over 54,000 per cu. ft., and in some places breeding of *Musca domestica*, L., was even more dense. Green strippings became infested soon after exposure and produced adults of *S. calcitrans* in less than 18 days. Infestation and the ability of uncovered waste to produce more than one generation appeared to depend more upon the weather and size of the pile than upon its age. Strippings piled only about a foot high desiccated too fast in dry weather to allow the development of a second generation. Where strippings of different ages were repeatedly piled in one place, continuous breeding of *S. calcitrans* and *M. domestica* and also dense breeding of *Drosophila repleta*, Woll., and *Hermetia illucens*, L., occurred.

Tests of various larvicides applied to the piles are described ; some proved effective, but in view of the expense and labour involved in treating the huge quantities of deposited litter, it is considered much more practicable to crush the waste at the washing plant, and pass the pulp on an automatic conveyor through a vat of diluted larvicide. An aqueous solution of sodium arsenite is stated in a foot-note to have since been found to be as effective as others for this purpose, and cheaper. Crushing reduces the waste to 25–35 per cent. of its former bulk, and it is thought that the saving effected in disposing of the smaller quantity and the proceeds of sale of juice would more than offset the cost of the machinery and insecticide.

Headlee (T. J.). **A Continuation of the Studies of the relative Effects on Insect Metabolism of Temperature derived from constant and varied Sources.**— *J. econ. Ent.* **35** no. 5 pp. 785–786, 1 graph, 1 ref. Menasha, Wis., 1942.

Further studies of the development of *Aëdes aegypti*, L., at varying and constant temperatures [*cf. R.A.E.*, B **29** 45 ; **30** 37] were carried out to ascertain the ratios of the metabolic powers (effects on duration of development) of the former to those of the latter at different points in the temperature scale of this mosquito. The days elapsing between hatching and adult emergence at constant and varying temperatures and (in brackets) the percentages of larvae reaching the adult stage were : 38·5 (32) and 55 (15) at 60 and 55–65°F. ; 30·5 (79) and 32 (77) at 63 and 58–68°F. ; 22·5 (90) and 22 (91) at 66 and 61–71°F. ; 14·5 (83) and 13 (89) at 74·5 and 68–81°F. ; and 10·5 (69) and 10·5 (77) at 86 and 81–91°F. The ratios of the power of the varying temperature to that of constant at these five positions in the scale are 1 : 1·42, 1 : 1·05, 1 : 0·97, 1 : 0·89 and 1 : 1, respectively, so that only in the fourth position (the straight line section of the sigmoid curve representing the reaction of the insect to temperature) did the power of the varying temperature appreciably exceed that of the constant, doing so at that point by about 10 per cent., while in the lowest sections (first and second positions), the metabolic power of the constant was materially the greater. The minimum number of mosquitos used in each series was 100. The results are considered to be reliable when at least 80 per cent. emerged.

In similar studies now in progress with *Culex pipiens*, L., it has been established that the ratio between the metabolic power for the variable and the constant in the top section of the curve is 1 : 1. *C. pipiens* is a temperate species developing at 56°F., but not above 87°F., whereas *A. aegypti* is tropical and sub-tropical and can complete development at temperatures as high as 94°F., but not below 60°F.

DEONIER (C. C.) & LINDQUIST (A. W.). **Effect of certain Larvicides on the overwintering Larvae of the Clear Lake Gnat.**—*J. econ. Ent.* **35** no. 5 pp. 788–789. Menasha, Wis., 1942.

As larvae of *Chaoborus* breathe by gills, do not normally come to the surface of the water, and are predacious and selective in capturing their prey, they cannot be killed by contact poisons that do not remain in solution or finely divided suspension or by stomach poisons. The use of larvicides for the control of *C. astictopus*, Dyar & Shann., in the Clear Lake, California, does not appear practicable, but the results of laboratory tests of several on the overwintering larvae are given in order to show the great susceptibility of the insect to them. For example, a pyrethrum solution (1 gm. total pyrethrins per 100 cc. of a mixture of 3 parts diesel oil and 2 parts carbon tetrachloride) gave 93 per cent. mortality when the concentration of pyrethrins in the water was only 0·1 part per million.

MCGOVRAN (E. R.) & SULLIVAN (W. N.). **Two Activators for Pyrethrins in Fly Sprays.**—*J. econ. Ent.* **35** no. 5 p. 792, 3 refs. Menasha, Wis., 1942.

A spray of refined petroleum oil containing 0·5 mg. pyrethrins per millilitre of spray with the addition of 3 per cent. methylphenylnitrosoamine as activator for the pyrethrins caused 65 per cent. mortality of *Musca domestica*, L., in two days, one in which the activator was 5 per cent. 2, 4-diamylcyclohexanol caused 43 per cent. mortality, and the official test insecticide, which contains about 1 mg. pyrethrins per millilitre, caused 25 per cent. mortality. The increases in kill brought about by the addition of the two activators were highly significant and significant, respectively. Used alone in highly refined kerosene, they caused percentage mortalities of only 6 and 11, respectively, at a concentration of 2 per cent. and 11 and 12 at a concentration of 5 per cent. The tests were made by the turntable method [*R.A.E.*, B **26** 246]. When exposed to daylight for four weeks in clear-glass bottles, the spray containing 3 per cent. methylphenylnitrosoamine developed a slight dark discoloration, and all samples containing the amine were discoloured after 10 weeks. Under similar conditions, sprays containing 2, 4-diamylcyclohexanol showed no discoloration.

STEIN (C. D.), LOTZE (J. C.) & MOTT (L. O.). **Transmission of Equine Infectious Anemia by the Stablefly,** *Stomoxys calcitrans*, **the Horsefly,** *Tabanus sulcifrons* **(Macquart), and by Injection of minute Amounts of Virus.**—*Amer. J. vet. Res.* **3** no. 7 pp. 183–193, 2 figs., 6 graphs, 12 refs. Chicago, Ill., 1942.

The literature on the attempted transmission of infectious anaemia (swamp fever) of horses by Arthropods is reviewed. Apart from the work of Scott [*R.A.E.*, B **11** 102 ; **13** 86 ; *cf.* also **23** 270], most of the observations made in the past were suggestive but inconclusive. An account is given of four experiments on the transmission of an unusually virulent strain obtained during an outbreak of the disease in Wyoming in 1941 by Tabanids (*Tabanus sulcifrons*, Macq.) and stable flies (*Stomoxys calcitrans*, L.) caught at Beltsville, Maryland. The Tabanids were used within two hours of capture ; the stable flies were kept for 24–48 hours in cages containing a dish of water with a few drops of honey to allow them to digest any previous meal. The transfer of the flies from an acutely infected to a susceptible horse was effected quickly ; and, in the case of the Tabanids, they were returned to the infected horse after they had begun to feed on the susceptible one, and the process was repeated until they refused to feed. A susceptible horse that thus received 20 bites from 8 Tabanids developed subacute infection after an incubation period of 11 days, but survived ; and one that received 60 bites from 16 Tabanids developed an acute infection after 10 days and died 52 days after exposure. Subcutaneous injection of a saline suspension of the mouth-parts of the 24 flies used in these experiments resulted

in the development of the acute form of the disease after an incubation period of 16 days, and death occurred on the 49th day after exposure. Finally, a horse that received about 233 bites from stable flies previously partly engorged on an infective one developed the disease in subacute form after 24 days and died 63 days after exposure. The fact that the incubation period was longer after numerous bites by *S. calcitrans* than after comparatively few bites by *T. sulcifrons* suggests that the larger mouth-parts of the latter carry and introduce a greater quantity of infective material and therefore that it may play a more important part in transmission.

Johnson (E. P.). **Further Observations on a Blood Protozoan of Turkeys transmitted by** *Simulium nigroparvum* **(Twinn).**—*Amer. J. vet. Res.* **3** no. 7 pp. 214–218, 6 figs., 8 refs. Chicago, Ill., 1942.

In further observations on the life-cycle of a blood parasite that infests turkeys in south-western Virginia [*cf. R.A.E.*, B **26** 189] and is now considered to be *Leucocytozoon smithi* [**28** 173], no schizogonous stages were found in tissues from 21 turkeys infected 24 hours to 12 days earlier. When three infected turkeys were kept protected from flies for a year, gametocytes could be demonstrated in the peripheral blood for the first six months, but not afterwards, whereas in control turkeys exposed to flies, gametocytes reappeared after the blood had been negative for two months. This indicated that asexual reproduction of the parasite did not take place in the turkeys. Continued observations led to the conclusion that the gametocytes occur in the plasma and not in any host cell. In *Simulium nigroparvum*, Twinn, the oöcysts were found in the stomach wall and not on it. It appears, therefore, from these and the previous observations [**26** 189], that macro- and microgametocytes are taken into the stomach of the Simuliids with blood from infected turkeys and develop into gametes. After fertilisation, the resulting zygote uncoils in the stomach contents of the fly to become a motile oökinete, which finds its way into the stomach wall where it becomes an oöcyst. This, after maturing, ruptures to release sporozoites, which find their way to the lumen of the salivary glands. When the infected flies bite turkeys, the sporozoites enter the blood stream, and develop in the plasma into gametocytes.

Mail (G. A.). **Tick Control with special Reference to** *Dermacentor andersoni* **Stiles.**—*Sci. Agric.* **23** no. 1 pp. 59–67, 24 refs. Ottawa, 1942.

Sporadic cases of tick paralysis of man and domestic animals are of almost annual occurrence in southern and central British Columbia, and there was a serious outbreak in cattle in the Kamloops district in the spring of 1941. No adequate means of controlling or repelling ticks have so far been found. Present knowledge on the subject is reviewed and discussed with particular reference to *Dermacentor andersoni*, Stiles, in British Columbia [*cf. R.A.E.*, B **28** 216]. As eradication of this species would involve destruction of the small mammals and birds on which the immature stages feed, which is impracticable, repellents are considered more useful against it than acaricides. One that would give protection for at least two weeks is needed for range animals, as it is not practical to round them up oftener. Dipping is considered the best method of applying a repellent to cattle, but if a dipping vat is not available, small numbers of animals can be sprayed. Localised dressings afford no protection from ticks, such as *D. andersoni*, that attack any part of the animal's body, but may be used to kill those already present. Avoiding infested pastures in spring is the only satisfactory method known for protecting sheep. Dusting is practicable only on a small scale, for instance for domestic pets or valuable show animals.

Ticks placed on bottle-fed lambs that had been receiving large doses of sulphur in their milk for several weeks attached readily, and one lamb became completely paralysed [*cf.* **21** 155]. The belief long held in South Africa that animals can be kept free from ticks by giving them daily doses of aloes has also been proved to be unfounded [**22** 115].

Arsenical dips are still the best means of ridding stock of ticks, but their effectiveness in giving protection from reinfestation remains in doubt [*cf.* **18** 179; **19** 36]. Dinitro-o-cresol and related organic compounds are effective acaricides, but more knowledge of their physiological action on mammals is needed before their use can be recommended. Certain thiocyanates have shown promise in laboratory trials. Plant extracts such as derris and pyrethrum are highly lethal to ticks and relatively non-toxic to mammals, but their cost is high and their lasting quality poor. Reports in the literature on the effectiveness of derris as a powder or wash are conflicting; the author and J. D. Gregson found that ticks would readily infest lambs treated heavily with derris powder, and although many were killed, a few succeeded in attacking and engorging.

Spraying vegetation with nicotine sulphate has exercised some control of *D. variabilis*, Say, in the eastern United States [**29** 137], but it is thought that this method would have very limited application in British Columbia. Sheep are of no value as tick traps, and the lanolin in their wool is not toxic or repellent to ticks. It is doubtful whether specific parasites of ticks could become established in the dry interior of British Columbia against *D. andersoni*, but it is thought possible that they might be used on the Pacific Coast against *Ixodes ricinus californicus*, Banks. Observations and experiments are cited to show that host animals can acquire definite immunity from attack by ticks [**30** 156, etc.].

[Kurchatov (V. I.).] **Курчатов (В. И.). Methods for the Control of Ticks and Insects injurious to Farm Animals.** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 11–12 pp. 26–29. Moscow, 1940. [Recd. 1943.]

This is a survey of recent experiments in the Russian Union on the control of Arthropods that attack domestic animals, including some in which the substances used were by-products of Russian factories, the composition of which is not definitely stated.

In tests by I. Egorov and A. Efimov in Kazan against *Dermacentor silvarum*, Olen., which transmits piroplasmosis of horses, many of the ticks on rabbits were killed by solutions of sodium arsenite that contained 0·2 or 0·24 per cent. As_2O_3 and in which 0·5 per cent. kerosene was emulsified with 0·14 per cent. soap. When the rabbits were treated 1–2 days after the ticks were placed on them, 85 per cent. of the male ticks and 60–80 per cent. of the females died in five days. Of the surviving ticks, 25 per cent. of the males and 10–40 per cent. of the females lived for 1½ months, and 10 per cent. of the females laid viable eggs. The stronger solution was the more toxic. When the rabbits were treated with the stronger and weaker solutions 1–2 days before the ticks were placed on them, the percentages that became attached were 50 and 70–75, respectively, and of these 25–50 per cent. of the males and 30–50 per cent. of the females died in a few days; 25 per cent. of the surviving males lived for 15 days and 10 per cent. of the females lived for 1½ months and laid viable eggs.

In investigations by I. A. Yuzefovich in the region of Ordzhonikidze (northern Caucasus), cattle dipped at intervals of 5 days in an arsenical solution containing 0·16 per cent. As_2O_3 were completely freed from *Boophilus calcaratus*, Bir., after the third treatment, but the dip was not so effective against *D. silvarum* or *Haemaphysalis otophila*, Schulze. In a region in which equine piroplasmosis is common, G. V. Tyurin obtained good results by collecting and destroying the ticks daily and rubbing the horses with a mixture of creolin, kerosene and tar, which decreased the number of cases by over 70 per cent.

In tests by N. Piskunov, washing with a mixture of naphthalene, naphthene soap and kerosene in water rapidly destroyed lice on pigs without injuring the pigs except for a slight irritation of the skin in those that had been too much wetted. The effectiveness of creolin dips against mange in sheep was confirmed by N. Kondyurin in western Siberia, and camels were successfully treated in Kazakstan by tying them on to a wooden framework and lowering them into the liquid. Measures found effective by S. Kotov against mange caused by *Demodex* in dogs included daily smearing with 50 per cent. balsam of Peru, which gave complete control in 25–40 days, and applications of 50 per cent. carbon tetrachloride in castor oil.

[Tzelishcheva (L. M.).] **Целищева (Л. М.). Experiments in the Transmission of bovine Theileriasis by the Ticks** *Hyalomma* **(Koch, 1844).** [*In Russian.*]—*Sovetsk. Vet.* **17** no. 11–12 pp. 31–35. Moscow, 1940. [Recd. 1943.]

Piroplasmosis of cattle caused by *Theileria* is widely distributed in southern Kazakstan and is responsible for heavy losses. The species of *Hyalomma* found on infected farms were *H. detritum*, Schulze, *H. savignyi*, Gerv., *H. dromedarii*, Koch (*asiaticum*, Schulze & Schlottke), and *H. marginatum*, Koch. The first three of these are known vectors in the Russian Union and have transmitted *Theileria* to cattle experimentally, but *H. marginatum* was the only species of the genus present on some of the infected farms. To ascertain whether it is a vector, laboratory-bred larvae were allowed to feed on cattle severely infected with *Theileria annulata*. They moulted to the nymphal stage on the animals, and the engorged nymphs were transferred to an insectary and kept at 26–30°C. [78·8–86°F.] ; adults emerged in 21–29 days. Batches were subsequently placed on healthy animals, and both males and females transmitted *T. annulata* to them. Males that had transmitted the disease were kept in a cellar at 10°C. [50°F.] for 1½ months and again transmitted it to a healthy bullock.

Unfed adults of *H. savignyi* collected on cattle and in animal quarters on infected farms transmitted *T. annulata* to susceptible animals, which shows that cattle can become infected by ticks in cow-sheds as well as in the pastures. No infection was transmitted, however, by larvae or nymphs of *H. savignyi* or *H. marginatum* that were the offspring of females that had fed on cattle having an acute natural infection with *T. annulata*.

In further experiments, *T. mutans* was transmitted to susceptible cattle by adults of *H. marginatum* taken in an infected locality, by adults of this species that had fed in the larval and nymphal stages on a bullock harbouring parasites in its peripheral blood, and by adults of *H. savignyi* that were collected as nymphs from an infected cow.

Derrick (E. H.), Smith (D. J. W.) & Brown (H. E.). **Studies in the Epidemiology of Q Fever. 9. The Rôle of the Cow in the Transmission of human Infection.**—*Aust. J. exp. Biol. med. Sci.* **20** pt. 2 pp. 105–110, 1 fig., 5 refs. Adelaide, 1942.

A study showed that the occupations of almost all Q fever patients in Queensland, both in Brisbane and in country districts, brought them into more or less close association with cattle [*cf. R.A.E.*, B **28** 226]. This, together with the absence of cattle and scrub ticks (*Ixodes holocyclus*, Neum.) from Moreton Island, where infected bandicoots [*Isoodon torosus*] and bandicoot ticks (*Haemaphysalis humerosa*, Warb. & Nutt.) are numerous [**29** 53] but infection in man is unknown, suggested that cattle may be a link in the transmission of the disease to man. In experiments to test this theory, two calves that were inoculated with material from an infected guineapig had a brief, mild illness that was shown to be due to the infection. Infection in a small proportion of the adults of *Boophilus annulatus microplus*, Can., arising from several thousand

larvae that had been placed on one of the calves, was demonstrated by inoculating batches of them into guineapigs, but a long incubation period indicated that the amount of virus in the inocula was small. Tests with nymphs were negative. It is thought that on the days on which the calf's blood was infective, all of the ticks had ceased to feed as larvae and only a few had begun to feed as nymphs. The offspring of 66 females, only one of which was proved to be infectious, failed to produce infection when inoculated into guineapigs. Tick faeces collected from the calf were infective after storage for 87 days. Agglutinins for *Rickettsia burneti* were found in the sera of 13 out of 879 dairy cattle from 16 farms in the endemic area [*cf.* **29** 53]. The farmers did not recall any apparent illness in the reacting cows in the previous few months.

It appears likely that cows become infected primarily from the native animal reservoir by *I. holocyclus*, a three-host tick that is common on bandicoots in the endemic area, attacks cattle, and has been found capable of transmitting Q fever in the laboratory. *H. humerosa*, a proved vector [**28** 228], and other ticks may also carry infection from bush animals to cattle. *B. a. microplus*, a one-host tick, could not maintain a cycle of infection in bovines unless transovarian passage of the rickettsia, which has not been demonstrated, took place, but the three-host cattle tick, *H. bispinosa*, Neum., which also occurs within the endemic area, has been proved to be a potential vector. Infection of man in country districts may therefore be ascribed to direct attack by native ticks in the absence of cattle, direct infection from body-tissues and fluids of an infected cow, and indirect infections from an infected cow through the tissues or excreta of ticks, principally *B. a. microplus*, feeding on it, or possibly through the agency of *H. bispinosa*, which is known to attack man in New Zealand [**11** 197]. Indirect infection is thought to be the most important method. Infection carried to an abattoir by cattle may be distributed there by direct or indirect means, the latter possibly including the inhalation of dust containing tick faeces.

PESCOTT (R. T. M.). **Two Springtails (Collembola) of medical Interest.**—*J. Aust. Inst. agric. Sci.* **8** no. 2 pp. 68–69, 3 refs. Sydney, 1942.

Accounts are given of various cases of skin trouble that occurred in Victoria, Australia, and were found to be attributable to Collembola of the genus *Entomobrya*. The first was recorded in 1939. The symptoms were a sharp biting sensation followed by intense irritation distributed generally over the trunk and limbs, but most marked round the waist, and there were a few marks on the body with an occasional excoriated papule. Several individuals of *E. multifasciata*, Tullb., were found on the patient's body. She received no direct treatment, but her clothes and bedclothes were sterilised, and this destroyed the insects and thereby removed the irritation. The origin of this infestation appeared to be disturbed grass, weeds and soil in the garden. The other cases occurred in 1941 among the nursing staff of a hospital and were caused by *E. tenuicauda*, Schött. Infestation resulted in raised lumps similar to mosquito bites with considerable irritation, and in one instance there was a good deal of reddening of the skin. These conditions lasted for somewhat less than 24 hours, but occurred again next day, probably as a result of fresh attacks. It appears certain that the springtails were introduced to the hospital with flowers. H. Womersley suggested that the insect's long, ciliated hairs, which are easily detached, would cause irritation, but the author considers it improbable that they were responsible for these cases as a distinct biting sensation was reported.

ILLINGWORTH (J. F.). **An Outbreak of Cockroaches,** *Nauphoeta cinerea* **(Olivier), in Honolulu.**—*Proc. Hawaii. ent. Soc.* **11** no. 2 pp. 169–170. Honolulu, 1942.

Nauphoeta cinerea, Ol., which had previously been considered rather rare in Hawaii, recently appeared in very large numbers in buildings on a poultry

farm, particularly in and around a room where poultry food was kept. Notes are given on its distribution and bionomics, the latter from observations made by the author since 1914. Gravid females were found to contain 28–40 eggs, and normally retained them within the body until they hatched. These cockroaches are omnivorous and thrived particularly on balanced poultry feeds. They have been observed to kill and eat individuals of *Diploptera dytiscoides*, Serv., and will eat their own dead. They are preyed on by *Pheidole megacephala*, F., and can be destroyed with sodium fluoride, which they consume while cleaning themselves. However, as it would be unsafe to use where poultry might eat the poisoned cockroaches, the infested buildings were sprayed with a mixture of carbolic acid and a light poultry oil, which killed all the cockroaches hit and considerably reduced the infestation.

WILLIAMS (F. X.). *Ampulex compressa* **(Fabr.), a Cockroach-hunting Wasp introduced from New Caledonia into Hawaii.**—*Proc. Hawaii. ent. Soc.* **11** no. 2 pp. 221–233, 20 figs., 14 refs. Honolulu, 1942.

Much of the information given in this paper on the introduction of *Ampulex compressa*, F., into Hawaii for the control of cockroaches has already been noticed from another source [*R.A.E.*, B **31** 81]. Two small consignments of the Sphegid have been released on the Island of Maui and one on Kauai, and it seems to be well established in Oahu, as it has been seen in one locality about the buildings of a chicken farm for about a year. It immediately conformed to the changed seasons on being transferred from the southern to the northern hemisphere. A detailed account is given of the way in which the females caught in New Caledonia were kept and transported, and of their manner of dealing with their prey and the life-history of the immature stages. Partly grown individuals or adults of *Periplaneta americana*, L., were supplied at the rate of 1–2 each day to each of the females, which were kept in separate gallon glass jars, as they are quarrelsome ; cardboard tubes were provided as nesting holes and débris for stopping the tubes. The Sphegids paired readily in large jars, and a female that had paired once could parasitise dozens of cockroaches. Little notice was taken of *Nauphoeta cinerea*, Ol., and *Diploptera dytiscoides*, Serv., was effectively paralysed once but not parasitised.

SONI (B. N.). **Eggs of the Goat Warble-fly** (*Hypoderma crossii* **Patton**).—*Curr. Sci.* **11** no. 7 pp. 280–281, 1 fig., 4 refs. Bangalore, 1942.

The previously unknown eggs of *Hypoderma crossi*, Patton, are described from Barbary goats in the Jhelum and Kulu valley districts of the Punjab [*cf.* *R.A.E.*, B **29** 54]. They were found on the underside of the hairs of the back, attached in rows to a single hair.

HOPKINS (G. H. E.). **Notes on Trichodectidae (Mallophaga).**—*Rev. brasil. Biol.* **2** no. 4 pp. 439–453, 3 figs., 31 refs. Rio de Janeiro, 1942.

Nearly half of this paper is devoted to a detailed discussion of the disputed nomenclature of the three species of Trichodectids that infest domestic goats, which the author identifies as *Bovicola* (*Trichodectes*) *caprae*, Gurlt, *B.* (*T.*) *limbatus*, Gerv., and *Holakartikos* (*T.*) *crassipes*, Rudow. No less than 17 names have been employed for the three species, and the name *Trichodectes limbatus* has been used for each of them. The types of *limbatus* and one of its synonyms being lost, the author fixes their identity by designating neotypes. *B. caprae* and *B. limbatus* are normally parasites of common and Angora goats, respectively. *H. crassipes*, apart from obvious accidental contaminations, has been

found only on Angora goats. Where the two kinds of goat are in close association, as in South Africa, there is some interchange of the two species of *Bovicola* between them.

[Shmeleva (Yu. D.).] **Шмелева (Ю. Д.). Envahissement par la végétation du réservoir d'eau d'Ivankovo du canal Moscva-Volga et son peuplement par les larves de l'*Anopheles maculipennis messeae* Fall. durant les 3 années de son existance.** [*In Russian.*]—*Med. Parasitol.* **9** no. 3 pp. 185–192, 3 graphs. Moscow, 1940. [Recd. 1943.]

Observations were made on the changes that took place in 1937–39 in the character of the large reservoir near Kalinin that was brought into operation in 1937 [*cf. R.A.E.*, B **27** 220], in order to obtain information as to the probable infestation with Anopheline larvae of similar reservoirs that it is planned to construct. Details are given for each year of the aquatic vegetation that developed, much of which provided increasingly favourable conditions for the breeding of *Anopheles maculipennis* var. *messeae*, Flni. The larvae of this Anopheline became more abundant each year, and the numbers of adult mosquitos in the neighbouring village also increased, until in July 1939, 7,500 were taken at one time sheltering by day in a single small cow-shed.

[Ovchinnikov (K. M.) & Tishchenko (O. D.).] **Овчинников (К. М.) и Тищенко (О. Д.). Descentes d'eau dans les petites rivières et les canaux comme mesure de lutte contre les larves d'*Anopheles*.** [*In Russian.*]—*Med. Parasitol.* **9** no. 3 pp. 204–224, 11 figs., 14 refs. Moscow, 1940. (With a Summary in French.) [Recd. 1943.]

A detailed account is given of investigations on the effect of flushing on larvae of *Anopheles maculipennis*, Mg. [*cf. R.A.E.*, B **28** 185], carried out in 1937 in sections of two small steppe rivers in the Provinces of Donetz and Kharkov. The rivers were shallow and slow-flowing, with dense vegetation, and the discharge of water was regulated by sluices. The results were estimated by counting the larvae in samples taken from various positions in the river and the adjoining swampy areas and side ditches. They showed that flushing dislodged larvae of all instars and pupae when the surface velocity of the wave was about 6 ins. per second or more, and that the numbers that were washed downstream increased with the velocity of the current. The percentage of larvae killed depended on the volume and force of the wave. All were killed for 220–550 yards below the weir or sluice where the water was most turbulent and the rise in the water-level was greatest. Flushing did not affect rooted aquatic plants but removed most of the plankton flora. Some of the larvae were killed by direct physical injury and others by being stranded on the banks, and mortality continued for 3–4 days. Flushing at regular intervals also decreased the abundance of larvae by destroying favourable breeding places. Its effectiveness was reduced by winding banks, a sudden broadening of the river bed or obstructions caused by dense vegetation or débris. It is important, therefore, to improve the condition of the banks and river beds.

It is concluded that periodical flushing may be of considerable value in freeing drainage and irrigation ditches and small steppe rivers from Anopheline larvae, for which purpose small sluices should be installed in them. In the southern Ukraine, the water should be discharged at intervals of not more than 10 days to prevent the emergence of adults of *A. maculipennis*, and to obtain complete mortality of the larvae stranded after flushing on the banks above the sluices, they should be thoroughly drained and the banks and bottom left to dry for

5–6 consecutive days. Flushing the main stream also freed side ditches from the larvae, which were washed away when the water level in the stream fell after flushing.

[Popov (P. P.) & Akhundov (I. A.).] **Попов (П. П.) и Ахундов (И. А.). Zur Frage über das Studium des Zeckenrückfallfiebers in Aserbaidjan.** [Contribution to the Study of Tick-borne Relapsing Fever in Azerbaijan.] [*In Russian.*]—*Med. Parasitol.* **9** no. 3 pp. 255–259. Moscow, 1940. (With a Summary in German.) [Recd. 1943.]

The authors first observed cases of tick-borne relapsing fever in Azerbaijan in 1932, and collected adults of *Ornithodoros verrucosus*, Olen., Zas. & Fen., a description of which is given, in August 1936. They occurred in the burrows of voles in an uninhabited locality near Baku, where a man had contracted the disease in September 1935 [*R.A.E.*, B **24** 209]. The ticks transmitted a strain of spirochaetes to the guineapig on which they were fed [*cf.* **26** 8], and this strain proved pathogenic to many other animals. In investigations on the reservoir of the spirochaetes in nature, two of 17 jerboas (*Allactaga*) caught in the environs of Baku were found infected, and a strain was isolated from the brains of ten examples of the vole, *Chilotus* (*Microtus*) *socialis*, also taken near Baku, which was fatal to a guineapig and pathogenic to man.

Other species of *Ornithodoros* found in Azerbaijan are *O. tholozani*, Lab. & Mégn. (*papillipes*, Bir.), *O. lahorensis*, Neum., and *O. canestrinii*, Bir.

[Olsuf'ev (N. G.).] **Олсуфьев (Н. Г.). Nouvelles données expérimentales sur la transmission de l'infection tularémique par les taons** (*Tabanus*). [*In Russian.*]—*Med. Parasitol.* **9** no. 3 pp. 260–271. Moscow, 1940. (With a Summary in French.) [Recd. 1943.]

Further investigations on the transmission of tularaemia by Tabanids [*cf.* *R.A.E.*, B **26** 11] were carried out in the summers of 1935 and 1936 in south-eastern Kazakstan. The supposition that they attack rodents, including hares, in the field was supported by experiments in which two species of *Tabanus* fed repeatedly on a rabbit immobilised in a frame and exposed for an hour in a shaded place.

In transmission experiments with single examples of six species of Tabanids, positive results were obtained with four species, all of the genus *Tabanus*. The flies were allowed to feed on artificially infected water-voles [*Arvicola*] that were dying of tularaemia or had died of it from 30 minutes to 42 hours previously; they were then transferred to healthy guineapigs either immediately or after intervals of from 30 minutes to 5 days. Of 44 experiments, 19 gave positive results, and in 15 of these the guineapigs died. Most of the infections were obtained when the flies were transferred immediately to the healthy animal; transmission was effected after an interval of 34 hours in one case, but not after 3 days [*cf.* **27** 241] or more. Fatal infection by only one bite was effected in two instances, and a single fly infected two guineapigs in succession when transferred immediately after feeding on a vole that had died 42 hours previously.

In further tests, the ability of *Tabanus* spp. to transmit the disease after contact with infected water [*cf.* **27** 241] was investigated. The carcass of a water-vole that had died of tularaemia was cut open and placed in water kept at 20–27°C. [68–69·8°F.], and the flies were induced to drink drops of the water after various periods and transferred immediately to healthy guineapigs. Of the 8 tests, 4 gave positive results; the water was infective after 8 and 19 days, but not after 31, and this was confirmed by injections of it into mice.

Injections into mice of suspensions of the faeces or digestive tracts of Tabanids that had fed on a vole dying of tularaemia indicated that the bacteria were present in the faeces for only 3–4 days, and were not present in the digestive tract after 6–7 days [*cf.* **26** 12].

[VAĬNSHTEĬN (N. B.).] **Вайнштейн (Н. Б.). Sur la fécondité saisonnière de l'*Anopheles maculipennis messeae* Fall.** [*In Russian.*]—*Med. Parasitol.* **9** no. 3 pp. 301–307. Moscow, 1940. (With a Summary in French.) [Recd. 1943.]

Investigations on the oviposition of *Anopheles maculipennis* var. *messeae*, Flni. [*cf. R.A.E.*, B **26** 241] were continued from 19th May to 15th September 1938 in Astrakhan. Females that had already fed were collected once every five days from day-time shelters and kept singly at 25–28°C. [77–82·4°F.] and 90 per cent. relative humidity in small muslin cages containing water. After they had oviposited, they were artificially fed [*cf.* **24** 265] on blood to induce further oviposition, and this was repeated until they died. The percentage of females that oviposited decreased after each successive feed. The majority oviposited only once and the percentage that did not oviposit increased from 23·9 in May to 46·1 in September. The number of eggs laid also decreased after each blood-meal. Two females oviposited six times, one laying 1,061 eggs in July–August and the other 799 in August–September. The largest single batch was laid by a female that oviposited only once and then died. The percentages of females that digested blood but did not oviposit were considerable during the peak period of fat-formation, but many such females oviposited after a further blood-meal.

[DOĬNIKOV (A. V.).] **Дойников (А. В.). Quatre années de lutte contre le moustique ailé.** [*In Russian.*]—*Med. Parasitol.* **9** no. 3 pp. 307–309. Moscow, 1940. [Recd. 1943.]

In the region of Astrakhan, many small railway stations and the huts of railway workers are situated in or near large swamps, and the mosquitos that breed there readily invade the buildings in numbers. As a measure for the control of malaria, systematic destruction of Anophelines in their day-time shelters was begun in the spring of 1935 in a number of settlements along the line leading to Astrakhan. Practically all the mosquitos were knocked down when sprayed with a 2–3 per cent. solution of naphthene soap and most of them were caught on a muslin shield held by a second man under the section of the ceiling that was being sprayed ; those that fell to the ground were sprayed again, as otherwise up to 54 per cent. revived. The buildings were sprayed 40–80 times during the season, and the hibernation quarters were similarly treated. More buildings were sprayed each year, and by 1938 the incidence of malaria along this section of the line was reduced by 67·3 per cent. as compared with 1935.

MAZZA (S.), MIYARA (S.), BASSO (G.) & BASSO (R.). **Primer quinquenio de la investigación por la M.E.P.R.A. de la enfermedad de Chagas en la provincia de Mendoza.** [The first Quinquennial of the Investigation on Chagas' Disease in the Province of Mendoza by the Mission for the Study of Argentine Regional Pathology.]—36 pp., illus. Mendoza, Misión Estud. Pat. reg. argent., 1941. [Recd. 1943.]

This survey of work in 1936–1940 on Chagas' disease in the province of Mendoza, Argentina, includes records of the Triatomids taken there. They are

Triatoma infestans, Klug, *T.* (*Eutriatoma*) *patagonica*, Del Ponte, *T. platensis*, Neiva [*R.A.E.*, B **23** 246] and *Eratyrus eratyrusiforme*, Del Ponte. The first two were found infected with *Trypanosoma* (*Schizotrypanum*) *cruzi*.

VIANA MARTINS (A.) & MACEDO (E.). **Nota sobre a molestia de Chagas na Bolivia.** [A Note on Chagas' Disease in Bolivia.]—*Brasil-med.* **56** no. 33 pp. 392–393. Rio de Janeiro, 1942.

MAZZA (S.). **Consideraciones sobre la enfermedad de Chagas en Bolivia.** [Remarks on Chagas' Disease in Bolivia.]—*Prensa méd. argent.* **29** no. 51 repr. 15 pp. Buenos Aires, 1942.

The authors of the first paper state that the only record known to them of infection of any Triatomid in Bolivia by *Trypanosoma* (*Schizotrypanum*) *cruzi* is that of Neiva in 1916, who found that almost all of a batch of *Triatoma infestans*, Klug, taken in the Department of Potosi were naturally infected. Their own observations showed infection in 5 of 6 males, all of 6 females, and 6 of 10 nymphs of *T. infestans* taken in a locality in south-western Bolivia.

The author of the second paper points out that he himself in 1937 recorded natural infection of *T. infestans* by *Trypanosoma cruzi* in various parts of Bolivia ; 35 per cent. of the bugs were infected at about 12,000 ft. and 66 per cent. at about 9,000 ft. He gives further records of natural infection of *Triatoma infestans*, and states that *T.* (*Eutriatoma*) *sordida*, Stål (the eggs of which were parasitised by a species of *Telenomus*), and a single individual of *T.* (*E.*) *oswaldoi*, Neiva & Pinto, were also observed to be infected. *Psammolestes coreodes*, Bergr., taken in birds' nests, was not.

PESSÔA (S. B.) & COUTINHO (J. O.). **Infecção natural e experimental dos flebotomos pela *Leishmania brasiliensis*, no Estado de São Paulo.** [Natural and experimental Infection of *Phlebotomus* by *L. brasiliensis* in the State of São Paulo.]—*Hospital* **20** no. 1 pp. 25–35. 1941. (Abstr. no. 15557 in *Biol. Abstr.* **16** no. 6. Philadelphia, Pa., 1942.)

Of 9,273 sandflies (*Phlebotomus*) collected in infected zones of the State of São Paulo, Brazil, 21 harboured *Leishmania brasiliensis*. It was found predominantly from September to February in *P. migonei*, França, *P. pessoai*, Coutinho & Barretto [*cf. R.A.E.*, B **30** 128] and *P. whitmani*, Antunes & Coutinho. *P. whitmani* and *P. fischeri*, Pinto, were experimentaly infected by feeding on *Leishmania* nodules of monkeys ; the forms of the parasite in them were identical with those in naturally infected sandflies.

AYROZA GALVÃO (A. L.) & LANE (J.). **Observações sobre alguns anofelinos de Salobra, Mato Grosso (Diptera, Culicidae).** [Observations on some Anophelines of Salobra.]—*Rev. Biol. Hyg.* **11** no. 1 pp. 10–18. 1941. (Abstr. no. 13787 in *Biol. Abstr.* **16** no. 5. Philadelphia, Pa., 1942.)

The authors describe two types of eggs of *Anopheles triannulatus*, Neiva & Pinto, from Salobra in the State of Matto Grosso, Brazil, which are quite different from those of *A. triannulatus* var. *davisi*, Paterson & Shannon, from São Paulo [*cf. R.A.E.*, B **30** 109]. The larvae of the typical form of *A. triannulatus* show filamentous leaflets on the inner submedian prothoracic tufts instead of the palmate hairs of those of var. *davisi*. The authors also describe variations of the adult markings of *A. triannulatus*, which confirm that *A. bachmanni*, Petrocchi, and *A. cuyabensis*, Neiva & Pinto, are synonyms of it [*cf.* **27** 227]. *A. triannulatus* is very zoophilous, as compared with *A. darlingi*, Root, which, as elsewhere in the Neotropical region, is highly anthropophilous.

Pereira Barretto (M.). **Sobre a alimentação dos flebotomos criados em laboratorio.** [On the Nutrition of *Phlebotomus* bred in the Laboratory.]—*Rev. Biol. Hyg.* **11** no. 1 pp. 28–34. 1941. (Abstr. no. 13788 in *Biol. Abstr.* **16** no. 5. Philadelphia, Pa., 1942.)

The percentage of laboratory bred females of *Phlebotomus intermedius*, Lutz & Neiva, and *P. whitmani*, Antunes & Coutinho, that would take a blood-meal was increased from 23·67 to 71·17 by previously feeding them on 10 per cent. solutions of dextrose or sucrose.

Correa (R. R.). **Observações sobre o** *A.* (*N.*) *darlingi* **Root, 1926, no Estado de São Paulo.** [Observations on *Anopheles darlingi* in the State of São Paulo.] —*Rev. Biol. Hyg.* **11** no. 1 pp. 40–54. 1941. (Abstr. no. 13790 in *Biol. Abstr.* **16** no. 5. Philadelphia, Pa., 1942.)

At Porto Feliz, on the left bank of the Tiete river in São Paulo, the author found several normal breeding places of *Anopheles darlingi*, Root, in the river bed. Of the 762 larvae collected, 706 were *A. darlingi*. The surface of the water was covered with *Eichhornia crassipes* and *Pistia stratiotes*.

Ayroza Galvão (A. L.) & Pereira Barretto (M.). **Sobre um novo anofelino de São Paulo** *Anopheles* (*Anopheles*) *pseudotibiamaculatus* **n. sp.** (**Diptera, Culicidae**). [On a new Anopheline from São Paulo.]—*Rev. Biol. Hyg.* **11** no. 1 pp. 65–70. 1941. (Abstr. no. 13786 in *Biol. Abstr.* **16** no. 5. Philadelphia, Pa., 1942.)

A description is given of *Anopheles pseudotibiamaculatus*, sp. n., from São Paulo, Brazil. It is distinguished from *A. eiseni*, Coq., *A. gilesi*, Neiva, and *A. tibiamaculatus*, Neiva, chiefly by the light areas on the wing veins, which are much more fragmented, as in *Arribalzagia*. *A. tibiamaculatus* is distinguished by the number and distribution of these areas from *A. eiseni*, with which it has usually been considered synonymous. As the male genitalia and larvae of *A. tibiamaculatus* and *A. pseudotibiamaculatus* were unknown to the authors, they refer these species provisionally to the subgenus *Anopheles*, on the basis of their adult characters [*cf.* next abstract].

Coutinho (J. O.) & Farias (G. S.). *Anopheles* (*Ayrozamyia*) *tibiamaculatus* (**Neiva, 1906**)—**descrição do macho e criação de novo sub-genero** (**Diptera, Culicidae**). [*Anopheles* (*Ayrozamyia*) *tibiamaculatus*, Neiva. Description of the Male and Erection of a new Subgenus.]—*An. Acad. brasil. Cienc.* **14** no. 4 pp. 343–347, 1 pl., 1 fig., 4 refs. Rio de Janeiro, 1942.

Adults of an Anopheline taken in Minas Geraes, Brazil, were found to agree with the original description of *Anopheles tibiamaculatus*, Neiva, and to be distinguished by characters of the male terminalia from *A. eiseni*, Coq. [*cf.* preceding abstract]. The adults of both sexes are described and a new subgenus (*Ayrozamyia*) is erected for it on the basis of the male terminalia.

Moulton (F. R.), ed. **A Symposium on Human Malaria with special Reference to North America and the Caribbean Region.** –Cr. 4to, viii+398 pp., illus. 28 pp. refs. Washington, D.C., Amer. Ass. Adv. Sci., 1941. Price, 32*s*. 6*d*. net. [Recd. 1943.]

The forty-four papers by various authors that compose this symposium together provide a systematic review of present knowledge on human malaria, its transmission and its control, with special reference to North and Central America and the West Indies. In the first, " Historical Introduction to the

Symposium on Malaria " (pp. 1–7), M. F. Boyd, the chairman of the Publication Committee, discusses the derivation and use of the word malaria, gives the various names applied to the forms caused by *Plasmodium vivax*, *P. falciparum* and *P. malariae*, reviews the early progress in basic scientific knowledge of the disease and its prevention and treatment, and points out the need for an intensification of research in the future with a view chiefly to developing cheaper control measures. The other papers are grouped under the headings : Parasitology, Anopheline Vectors, Epidemiology, Symptomatology, Pathology and Immunity, Treatment and Control and Eradication. Anopheles is used as a popular name to include the tribe, but the Neotropical *Chagasia bathanus*, Dyar, is the only species in the area considered that does not belong to the genus *Anopheles*.

The papers in the section on vectors include " Bionomics and Ecology of Nearctic Anopheles," by G. H. Bradley and W. V. King (pp. 79–87), which comprises a discussion of the longevity and resting places, pairing, biting and oviposition habits, attraction to light, hibernation, flight, migration and enemies of the adults, and the food, breeding places, specific aquatic requirements and enemies of the larvae ; " Distribution of the Nearctic Species of Anopheles," by King & Bradley (pp. 71–78, 4 maps) ; " Distribution and Ecology of the Anopheles Mosquitoes of the Caribbean Region," by L. E. Rozeboom (pp. 98–107) ; " Factors influencing Infection of Anopheles with Malarial Parasites," by C. G. Huff (pp. 108–112) ; and " The Transmission of Malaria by the Anopheles Mosquitoes of North America," by J. S. Simmons (pp. 113–130), in which some of the available published information on the spread of human malaria by the indigenous Anophelines is reviewed, each of the seven Nearctic and 23 Neotropical species being considered in turn, and it is pointed out that present knowledge is insufficient to indicate the relative importance of all the species.

In " General Morphology of Anopheles and Classification of the Nearctic Species " (pp. 63–70, 3 figs.), King & Bradley give the general characters of all stages of Anophelines, a summary of their classification according to Edwards [*R.A.E.*, B **21** 1] and Dyar [**16** 167], and a list of Nearctic species and subspecies of the subgenus *Anopheles*, with keys to the adults, male terminalia and fourth-instar larvae. This subgenus includes all the Anophelines of Canada and the United States, except *A. albimanus*, Wied., which is found in the lower Rio Grande Valley. The authors regard the varieties of *A. maculipennis*, Mg. (*occidentalis*, D. & K., *freeborni*, Aitken, and *aztecus*, Hoffmann, which does not occur in these countries) and those of *A. crucians*, Wied. (*crucians*, *bradleyi*, King, and *georgianus*, King) as distinct species, but state that S. B. Freeborn and T. H. G. Aitken [**30** 154] do not agree with this view as regards *A. maculipennis*. Variations in other species are discussed.

In " The Classification and Identification of the Anopheles Mosquitoes of Mexico, Central America, and the West Indies," by W. H. W. Komp (pp. 88–97), a list is given of the 27 species found in this area, the classification being that of Edwards except that his group *Kerteszia* is treated as a subgenus, a modification with which he had agreed. The characters of female adults, male terminalia, larvae and pupae are discussed, and keys are given to the females, male terminalia and larvae.

The section on epidemiology comprises " Cyclical Variation in the Incidence of Malaria," by C. F. Craig (pp. 131–134) ; " Topographical and related Factors in the Epidemiology of Malaria in North America, Central America and the West Indies," by R. B. Watson & R. Hewitt (pp. 135–147, 10 maps) ; " Malaria and the Community," by L. W. Hackett (pp. 148–156), a discussion of endemicity including the effect on rate of transmission of the host preferences of Anophelines ; and " The Rôle of Anophelines in the Epidemiology of Malaria," by R. Matheson (pp. 157–162), which includes a list of the species in the United States, showing those that have been infected experimentally and those that

are considered the principal vectors in North America, and discussions of outbreaks in the United States and Jamaica that have been associated with particular species and special conditions.

Papers on control include "General Considerations in planning Malaria Control," by J. Andrews (pp. 285–294, 4 figs.), which deals with the estimation of the intensity and distribution of malaria, selection of areas where control is to be carried out, making of malaria surveys, and selection and evaluation of suitable measures; "Methods directed against adult Mosquitoes in the Control and Eradication of Malaria," by D. M. Jobbins (pp. 302–307), in which the use of nets, traps, sprays, fumigants, poisons [**15** 72] and repellents, and deviation of Anophelines to animals are discussed; "Housing with special Reference to Mosquito-proofing for Malaria Control," by C. C. Kiker (pp. 308–314, 2 graphs), which is limited to a discussion of the relation of housing to malaria in the south-eastern United States, where the only vector of importance is *Anopheles quadrimaculatus*, Say, and reasonably effective methods of making a house mosquito-proof have been developed and used on a large scale pending improvement in the construction of houses, which is at present very poor; "The Management of Water for Malaria Control," by E. H. Hinman (pp. 324–332, 1 fig.), in which, in addition to brief reference to flushing and irrigation, the management of impounded water is discussed, both from the point of view of the preparation of a reservoir, which should include provision for effective variation in water-level, and of shoreline maintenance; "Adaptability of Control Measures to the Nearctic Fauna of Anopheles Mosquitoes," by H. A. Johnson (pp. 353–358), a discussion of control by water-level fluctuation, clearing of protective vegetation and floatage, drainage, filling, larvicides, the use of fish and other naturalistic and miscellaneous measures, and screening; and "The Adaptability of Control Measures to the Malaria Vectors of the Caribbean Region," by H. W. Kumm (pp. 359–364, 10 figs.), in which it is concluded that malaria can be controlled in circumscribed areas in the Region by measures directed against the vectors, but cannot be eradicated, that drainage should be used wherever possible, and that methods found successful in the Panama Canal Zone have proved effective in neighbouring countries.

In "Drainage and filling Methods for Mosquito and Malaria Control," by N. H. Rector (pp. 315–323, 5 figs., 8 diagrs.), the points to be observed in the preliminary survey and the methods that may be used are outlined, and specifications for an open ditch are given, with a discussion of the organisation and cost of the work and certain special problems. Under the heading of permanent drainage, underground drains and the filling of swamps are briefly discussed, and the construction of inverts of masonry, monolithic concrete or precast concrete is dealt with at some length [*cf.* **30** 68].

In "Petroleum Products for Mosquito Control," by J. M. Ginsburg & W. Rudolfs (pp. 333–336), a list is given of the properties desirable in an oil for the control of mosquito larvae, and the toxicity, spreading and penetration of oils and the quantity to be used are discussed. Notes are also given on the New Jersey larvicide [**23** 205], an emulsion of oil containing pyrethrum extract, which is recommended for use when the application of undiluted petroleum oil would be objectionable and is also effective as a spray against adult mosquitos at outdoor gatherings, and on the use of pyrethrum in undiluted oil as an indoor spray.

In "Paris Green (Aceto Arsenite of Copper) and other Stomach Poisons as Larvicides against Mosquito Larvae" (pp. 337–346), M. A. Barber deals with the chemical and other properties of Paris green, its dilution with dusts or water, the rate at which it should be applied, evidence that its proper use does not involve risks of poisoning man or domestic animals, or injury to rice plants, the frequency with which it must be applied, its use against Culicines and the distribution of dusts by aeroplane or boat and of liquids by autogiro. Points to be kept in mind in testing new stomach poisons for mosquito larvae are

given and attempts by the author and his colleagues to find new larvicides or improve the method of application of old ones are reviewed. Finally, the necessity for supervision of larvicidal work by a trained inspector is stressed.

The measures dealt with in "Naturalistic Methods of Malaria Control," by P. F. Russell (pp. 347–352), are the deviation of Anophelines from man to animals, the only naturalistic measure against adults considered worthy of attention, and the planting of trees to dry water-logged land, alteration of flora and of salt content of water, agitation of the surface of the water, pollution, shading, and the use of natural enemies against larvae.

The symposium concludes with a paper entitled "The Anti-malaria Program in North America," by L. L. Williams, jr. (pp. 365–370, 4 maps, 1 chart). In this, the endemicity of malaria in the United States and countries to the south, and its intensity and periodicity in various regions, are discussed. When the periodicity is known, epidemics can be anticipated and prepared for. The organisation of anti-malaria work in the United States is described. It is in the charge of State malaria control and investigation units which, with the co-operation of the Federal public health service, work to eliminate major foci of infection, prevent new sources of Anopheline breeding resulting from engineering and similar works, initiate and maintain control projects and carry out educational campaigns. The organisation in smaller territories is outlined. For the future, it is suggested that the destruction of mosquitos in aircraft should be further studied, and firmer legislation be introduced with regard to impounding water and irrigation.

RUSSELL (P. F.), KNIPE (F. W.) & RAMANATHA RAO (H.). **On the intermittent Irrigation of Ricefields to control Malaria in South India.**—*J. Malar. Inst. India* **4** no. 3 pp. 321–340, 2 pls., 1 chart, 14 refs. Calcutta, 1942.

An account is given of experiments in 1938–41 on intermittent irrigation to control breeding of *Anopheles culicifacies*, Giles, the local vector of malaria, in rice-fields in Pattukkottai Taluk, Madras. The soil was very light, and intermittent irrigation was effective in fields and small channels when 5 wet days, during which sufficient water was supplied to maintain a constant depth of 4 ins., were followed by 2, 3 or 4 dry days. The water drained away in 30 minutes after the outlet pipe was opened, but pools in depressions took more than one day to dry. Dry periods of four days did not cause cracking of the soil or clod-formation, and the subsoil remained moist although the surface film disappeared. During a period of daily rains (which usually occurs in November during the north-east monsoon), it was not possible to control breeding by withholding irrigation water even for 4 days, but *A. culicifacies* does not breed much at that season. Intermittent irrigation throughout the entire growing season did not stimulate the growth of weeds or alter the species found, or lessen the yield of straw or grain or the quality of the rice in the absence of the fungous disease caused by *Piricularia oryzae.* There were indications that when the disease was present, intermittent irrigation during the flowering stage might increase the susceptibility of the rice to it and cause a reduction in the yield of grain but not of straw. However, larvae of *A. culicifacies* are uncommon by this time [*cf. R.A.E.*, B **29** 147–148]. It is recommended that intermittent irrigation with a cycle of approximately 5 wet and 2 dry days should be practised in Pattukkottai from the time that irrigation begins in mid-June until the rice is almost in flower.

In 1940–41, intermittent irrigation of the fields and field channels with $4\frac{1}{2}$ wet and $2\frac{1}{2}$ dry days was tested on a practical scale in two villages. The change in the cycle was made because the land was heavier than on the experimental plots and dried more slowly. Water was occasionally supplied during the dry period in the early stages of growth if there was evidence that the crop needed

it. Brief reference is made to other small-scale measures carried out concurrently to control breeding in borrowpits, wells, reservoirs and ponds. The mosquito population was considerably reduced during the early stages of rice growth. Fluctuations of water level in the main channel were ineffective, but Paris green dust was applied from automatic distributors [*cf.* **31** 76] installed at intervals of 1,200 ft. and operated twice weekly, and complete control resulted.

BHASKER RAO (R.) & RAMOO (H.). **Some Notes on the practical Aspects of Mosquito Control in Wells and Tanks by the Use of larvivorous Fish.**—*J. Malar. Inst. India* **4** no. 3 pp. 341–347, 1 pl., 2 refs. Calcutta, 1942.

Various factors that might contribute to the disappearance of *Gambusia affinis* and *Aplocheilus* (*Panchax*) *parvus* from wells into which they have been introduced for the control of Anopheline larvae are reviewed in the light of observations made in Pattukkottai Taluk, Madras. Those that appeared to be of importance are the predatory action of larger fish, frogs, kingfishers and other natural enemies, accidental removal, disproportion of the sexes among the fish introduced and possibly disease. Measures for counteracting these so far as possible are suggested. Shortage of food and changes in the dissolved oxygen and carbon dioxide content of the water did not appear to be involved. In reservoirs, the native *A. parvus* seemed to survive without special measures, but *G. affinis* did so only if measures were taken to exclude larger predatory fish and to prevent it from being washed away with the discharged water if the reservoir overflowed.

RUSSELL (P. F.) & JACOB (V. P.). **On the Epidemiology of Malaria in the Nilgiris District, Madras Presidency.**—*J. Malar. Inst. India* **4** no. 3 pp. 349–392, 2 pls., 1 map, 3 figs., 3 graphs, 26 refs. Calcutta, 1942.

The data for this survey were collected from January 1940 to January 1941, inclusive. The Nilgiris District, which is described, is arbitrarily divided into Nilgiris east, central and west, these divisions corresponding, respectively, to the eastern valley (including Kallar, which is actually in Coimbatore District), the central plateau, with an average altitude of 6,500 ft., and the Nilgiris-Winaad, a tableland with an elevation of some 3,000 ft. As well as the altitude, the rainfall and seasonal prevalence of malaria and Anophelines, particularly *Anopheles fluviatilis*, James, the chief and probably the only local vector [*cf. R.A.E.*, B **28** 162], vary markedly in these areas. Temperature and relative humidity are usually compatible with mosquito activity in all parts, and the Anopheline fauna is very rich, 22 species having been taken during these studies. One and a variety of another are recorded from Madras for the first time. All were taken in the larval stage, and their larval habitats and seasonal distribution are given. Altitude appeared to be a factor in determining distribution. *A. aitkeni*, James, and *A. gigas*, Giles, were most abundant above 4,000 ft., *A. fluviatilis* below 4,000 ft. and above 1,000 ft., and *A. culicifacies*, Giles, and *A. subpictus*, Grassi, below 2,000 ft. However, in seasons with unusually high average temperatures, *A. fluviatilis* may appear at levels up to 5,500 ft. Detailed data are given regarding adult collections, which also revealed seasonal trends. *A. fluviatilis* was prevalent throughout the year in the east, where rainfall is fairly evenly distributed, but was most abundant from April to July, whereas it was never so plentiful in the west, but was most so from February to June, and scarce during the heavy south-west monsoon rains from July to October. All adult collections are also analysed by resting places. Both in the east and in the west, *A. fluviatilis* was most common in human dwellings, where it rested on the walls near the floor or near the angle of the roof with the wall, but seldom high up on the inside of the roof. *A. jamesi*, Theo., *A. jeyporiensis*, James, *A. subpictus*, and *A. vagus*, Dön., the only other species taken

in large numbers as adults, were usually found in animal sheds. The oöcyst, sporozoite and total infection indices in the 2,580 females of *A. fluviatilis* dissected were 9·7, 10·1 and 17·3, respectively. Among 1,515 dissections of other species, no infections were found. With two exceptions (in November and January), the only infections in Nilgiris west were found in the months of May and June, whereas infected females were found at Kallar in every week from 4th March 1940 to 20th January 1941, inclusive, and sporozoite infections in all but two of these weeks. The average spleen and parasite rates were 84·5 and 45·6 for Nilgiris east, 46·5 and 33·3 for Nilgiris west, and 5·6 and 1·6 for other areas, and spleen rates were 4·4, 78·1, 50·4 and 6·0 at altitudes of 1,000–1,100, 1,200–1,999, 2,000–3,999 and 4,000 ft. or higher, respectively. No evidence at all was found of malaria transmission at Coonoor (altitude 6,000 ft.) where the spleen rate was 0·9. *Plasmodium malariae* was three times as common as *P. vivax* and *P. falciparum* together in Nilgiris east, but less abundant than either elsewhere.

It is concluded, in accordance with old local belief, that whereas the eastern and western ghats of the Nilgiris are malarious, the central plateau is not, the dividing line being at an elevation of about 4,000 ft., or possibly 5,500 ft. in exceptional years or places. It appears, however, from spleen surveys in three towns at altitudes of 6,000 ft. or more, and from the study of an outbreak of malaria that occurred in a children's home at one of these places in September 1941, that sporadic transmission may occur in the central plateau following the entry of unusually large numbers of gametocyte carriers from malarious districts. *A. aitkeni*, *A. gigas* and *A. maculatus*, Theo., were fairly abundant near the home, but none of these species has been found to be a vector in the Nilgiris. One adult of *A. culicifacies*, which is thought to be rare at such an altitude, was taken, but none of *A. fluviatilis*.

Viswanathan (D. K.). **Malaria Control by Spray-killing adult Anophelines, second Season's Results: with special Reference to the Effects of this Measure on the Longevity and Infectivity of** *Anopheles minimus*.—*J. Malar. Inst. India* **4** no. 3 pp. 393–403, 4 graphs, 1 ref. Calcutta, 1942.

Spraying with pyrethrum extract in kerosene against *Anopheles minimus*, Theo., in a tea garden in Upper Assam [*R.A.E.*, B **30** 101] was continued in 1941. All the coolies' houses were sprayed weekly from 15th April to 10th December, and some of them twice weekly from 1st June to 31st October. The decrease in the incidence of malaria was slightly improved, the number of cases per thousand being 278. In all the adjoining gardens there was considerably more malaria than in 1940, principally on account of the early break of the monsoon in April and some spells of dry weather later in the year. The numbers of cases of malaria in 1940 and 1941 were 40 and 48 in the houses sprayed once weekly in both years, 255 and 283 in those sprayed once weekly in 1941 only, 139 and 109 in those unsprayed in 1940 and sprayed twice weekly in 1941, and 444 and 351 in those sprayed once weekly in 1940 and twice weekly in 1941. The first pair of figures indicates a higher degree of transmission during 1941, the second pair suggests that a larger human reservoir increased the chance of transmission, and the others show the advantage of spraying twice weekly.

Spleen rates were not reduced in either year, but there was a decrease in 1941 in the average size of enlarged spleens. Parasite indices in children 2–10 years old decreased steadily from 48·4 in January 1940 to 24·2 in November 1941. The index in infants fell from 31·6 in December 1940 to 13·1 in December 1941. As compared with the 1,515 larvae and 1,717 adults of *A. minimus* taken in 1940, 888 and 430 were taken in the same number of man-hours per month in 1941, the reduction in adults occurring after June where twice-weekly spraying was introduced. The total infection indices in *A. minimus* in the

unsprayed and sprayed areas in 1940 and the areas sprayed once and twice weekly in 1941 were 1·84, 0·48, 1·56 and 0·00, respectively. Estimates made in various ways of the age of females caught in the treated tea garden and in an adjoining one where no control was in progress showed that the proportion of younger individuals was greatly increased by spraying, particularly when it was done twice weekly. Data are given of the quantities of spray used in both years and of the cost.

Venkat Rao (V.), Roy (B. B.) & Jagannadha Rao (P.). **Observations on the Swarming and Pairing of *A. sundaicus* (Rodenwaldt) and *A. subpictus* (Grassi).**—*J. Malar. Inst. India* **4** no. 3 pp. 405–408, 2 refs. Calcutta, 1942.

A description is given of swarms of *Anopheles sundaicus*, Rdnw., and *A. subpictus*, Grassi, observed on 10th and 20th January 1942 at a railway station in Orissa about two miles from the Chilka Lake, where *A. sundaicus* is the main vector of malaria [*cf. R.A.E.*, B **28** 163]. It had been found necessary to institute malaria control measures at this and other stations in October 1941, and subsequent routine weekly adult catches revealed the presence of *A. sundaicus* in very much larger numbers than usual. On both evenings, the swarms comprised a mixture of both sexes of each species, *A. sundaicus* greatly predominating. One copulating pair of each species was caught leaving the swarms. The unusual density of *A. sundaicus* suggested that it was breeding in the neighbourhood. However, the larvae could not be found in local reservoirs and borrow pits, though four individuals of *A. subpictus* and 15 of other Anophelines were taken, whereas adults reared from larvae collected in the Chilka Lake comprised 37 males and 30 females of *A. subpictus*, 4 females of *A. vagus* and 232 males and 287 females of *A. sundaicus*. The flight-range of both sexes of the last-named must therefore be at least two miles. The reasons why swarming should occur so far from the breeding place are discussed.

Bhasker Rao (R.) & Ramoo (H.). **The Control of Mosquito-breeding in Canal Distributaries by growing certain Plants on their Banks.**—*J. Malar. Inst. India* **4** no. 3 pp. 409–415. Calcutta, 1942.

Observations in routine collections that larvae of *Anopheles culicifacies*, Giles, in branch irrigation canals in Pattukkottai Taluk (Madras) are most numerous where the banks are devoid of shrubs and creepers, were confirmed by an investigation from July 1939 to January 1940, in which they were found to be nearly three times as numerous on a section of a canal with clear edges as in one with a dense growth of *Ipomoea biloba*. In the latter, moreover, most of the larvae caught were in the third or fourth instar, which suggests that very little oviposition took place in this section. Attempts were therefore made to establish various plants along the edges of canals. In contrast to the others tried, *Vitex negundo* grew well near the water's edge, and its dense foliage provided both shade and mechanical obstruction to oviposition by the mosquitos. It is also possible that the strong aromatic odour of its leaves may repel them. In surveys made in 1940 and 1941, detailed results of which are given, breeding in sections of canal along which this plant had been established was extremely scanty compared with that in control sections with clear edges.

Roy (D. N.) & Biswas (T. C.). **On the Importance of *Anopheles pallidus* as a Carrier of Malaria in Udaipur State, Central Provinces.**—*J. Malar. Inst. India* **4** no. 3 pp. 417–420, 7 refs. Calcutta, 1942.

Udaipur State, in the Central Provinces, is a hilly tract some 150 miles west of Chaibassa, the administrative centre of the Singhbhum District. In a

malaria survey made between 18th August and 2nd November 1941, the spleen index of children in the capital (Dharamjaigarh) was found to be 60·8 per cent., denoting hyperendemicity. The 2,053 female Anophelines collected comprised 41 of *Anopheles vagus*, Dön., 38 of *A. fluviatilis*, James, 854 of *A. pallidus*, Theo., 969 of *A. culicifacies*, Giles, 115 of *A. subpictus*, Grassi, 32 of *A. jeyporiensis*, James, 1 of *A. aconitus*, Dön., and 3 of *A. annularis*, Wulp. Gland dissection of all of them yielded positive results in the case of *A. culicifacies* and *A. pallidus*, which had sporozoite rates of 0·5 and 0·7, respectively, indicating that the latter, as well as the former, should be regarded as a vector of major importance. All the infected females had been caught in dwelling houses, those of *A. pallidus* in August and September and those of *A. culicifacies* in September and October. Previous records of infection in *A. pallidus* are given [*R.A.E.*, B **24** 78; **27** 209], including one in a personal communication from R. Senior White who found an oöcyst rate of 0·8 in 7,513 females from Orissa, Singhbhum and Hazaribagh.

Bhupendra Mohan Khan. **Malaria in the Tista Valley, Darjeeling District.** (Abstract.)—*J. Malar. Inst. India* **4** no. 3 p. 421. Calcutta, 1942.

During 1941, dissection of 3,487 females of 12 species of *Anopheles*, including 779 of *A. annularis*, Wulp, and 1,725 of *A. maculatus*, Theo., all collected in the Tista and neighbouring valleys in the Darjeeling District, where malaria is prevalent up to 3,500 ft. above sea-level, gave negative results except in the case of 5 out of 94 females of *A. minimus*, Theo., 3 of which had gland infections, and all of which were collected 15 miles from Darjeeling at an altitude of 1,200 ft.

Panigrahi (R. G.). **Malaria in Puri.** (Abstract.)—*J. Malar. Inst. India* **4** no. 3 pp. 423–428. Calcutta, 1942.

The incidence of malaria in Puri, Orissa, is normally slight, but epidemics of varying intensity occurred in 1925, 1933, 1936 and 1940, which were all years of abnormally heavy rainfall. The outbreaks took place between August and December, the greatest number of cases usually occurring in November; in some years there was a minor rise in malaria incidence in March or April. A survey of the town made between 1st April 1940 and 31st March 1941 showed that the distribution of malaria is extremely irregular, the spleen rates ranging from 3 per cent. in one ward to about 70 per cent. in another. Fifteen species of *Anopheles* were collected either in the adult or larval stage, the most numerous being *A. annularis*, Wulp, *A. hyrcanus*, Pall., *A. vagus*, Dön., *A. ramsayi*, Covell, and *A. subpictus*, Grassi. *A. sundaicus*, Rdnw., constituted 1·8 per cent. of the total adult and 0·3 per cent. of the total larval collections. The highest salinity of water in which it was found breeding was 42 parts per 100,000 [*cf. R.A.E.*, B **27** 43]. As a result of 17,423 dissections, infections were recorded in *A. sundaicus* and *A. annularis*, which had oöcyst rates of 0·8 and 0·05 and sporozoite rates of 1·1 and 0·08 per cent., respectively, and a single gut infection was found in *A. ramsayi* in a total of 1,658 dissected. All the infections were in mosquitos collected during the last four months of 1940. The author considers that *A. sundaicus* is the principal vector and that *A. annularis*, which was more than 20 times as abundant, becomes infected only in years when an epidemic has been started by *A. sundaicus*.

Steinhaus (E. A.). **Catalogue of Bacteria associated extracellularly with Insects and Ticks.**—Demy 8vo, [1+] iii+206 pp., many refs. Minneapolis, Minn., Burgess Publ. Co., 1942. Price $2.00.

After a preliminary section that consists of a summary of pertinent literature on many biological relationships between Arthropods and extracellular bacteria that could not be dealt with satisfactorily under the individual species of

bacteria, the latter are recorded in alphabetical order under Orders, families, tribes and genera, the system of classification being that used in Bergey's Manual of Determinative Bacteriology (1939, 5th edn.). Under the heading of each species is given the name of the Arthropod or Arthropods concerned with it, followed by a synopsis of the nature of the relationship and references to the literature, including the paper in which the bacterium was originally described or mentioned. It is considered that these synopses will be of particular value to workers dealing with bacterial diseases of insects and the bacterial diseases transmissible directly or indirectly by insects and ticks to man and animals or by insects to plants.

BAERG (W. J.). **Introduction to applied Entomology.**—2nd edn. Demy 4to, [1+] vii+146 pp., frontis., 128 figs., many refs., multigraph. Minneapolis, Minn., Burgess Publ. Co., 1942. Price $2.25 *cts*.

This book, which is designed for students of agriculture and entomology, deals principally with the more important insect and Arachnid pests of crops, domestic animals and man in the United States. It consists chiefly of notes on the bionomics and control of individual species, followed by references to the literature on them, but also contains a section on the anatomy, life-history and economic importance of insects and one on control, in which the characteristics and uses of the principal insecticides are summarised.

PAPERS NOTICED BY TITLE ONLY.

UNTI (O.). **Anofelinos do Vale do Paraíba. Nova variedade e ciclo evolutivo do** ***Anopheles*** **(*Nyssorhynchus*)** ***oswaldoi*** **var.** ***ayrozai*** **n. var.** [Anophelines of the Parahyba Valley. A new Variety, *ayrozai*, of *A. oswaldoi*, Peryassú, and its developmental Cycle.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 363–375, 1 pl., 12 refs. São Paulo, 1942. [See *R.A.E.*, B **30** 147.]

CORRÊA (R. R.) & da S. RAMOS (A.). **Do encontro do** ***A.*** **(*N.*)** ***darlingi*** **Root, 1926, e do** ***A. oswaldoi*** **var.** ***metcalfi*** **Galvão & Lane, 1937, naturalmente infetados com os parasitas maláricos, na região sul do Estado de São Paulo.** [*Anopheles darlingi* and *A. oswaldoi* var. *metcalfi* naturally infected with malarial Parasites in the southern Part of the State of São Paulo.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 379–387, 5 figs., 11 refs. São Paulo, 1942. [See *R.A.E.*, B **31** 1.]

COUTINHO (J. O.) & PEREIRA BARRETTO (M.). **Contribuição ao conhecimento dos flebotomos de São Paulo. VII. Descrição de** ***Phlebotomus guimaraesi*****, n. sp. e das femeas de** ***Phlebotomus pestanai*** **Barretto e Coutinho, 1941 (Diptera, Culicidae).**—*Rev. Biol. Hyg.* **11** no. 1 pp. 74–83. 1941. (Abstr. no. 13791 in *Biol. Abstr.* **16** no. 5. Philadelphia, Pa., 1942.)

GRIFFITHS (J. T.) & TAUBER (O. E.). **The nymphal Development for the Roach,** ***Periplaneta americana*** **L.**—*J. N. Y. ent. Soc.* **50** no. 3 pp. 263–272, 1 graph, 14 refs. New York, N.Y., 1942.

PINTO (C.) & DE OLIVEIRA (S. J.). **Contribuição ao estudo da** ***Tunga penetrans*** **(L., 1758).** [A Contribution to the Study of *T. penetrans* (with a description of the spermatheca).]—*Rev. brasil. Biol.* **2** no. 4 p. 487, 1 fig. Rio de Janeiro, 1942.

COLCORD (M.). **Index VI to the Literature of American Economic Entomology January 1, 1935 to December 31, 1939.**—*Amer. Ass. econ. Ent.*, Spec. Publ. 6, [12+] 815 pp. College Park, Md., 1942. Price $6.00. Postage 50 *cents*. [*Cf. R.A.E.*, B **26** 128.]

SMITH (R. C.). **Guide to the Literature of the Zoological Sciences.**—Demy 4to, [1+] vii+128 pp. multigraph. Minneapolis, Minn., Burgess Publ. Co., 1942. Price $2.00.

TAYLOR (F. H.). **Contributions to a Knowledge of Australian Culicidae. No. V.**—*Proc. Linn. Soc. N.S.W.* **67** pt. 3–4 pp. 277–278, 8 figs., 1 ref. Sydney, 1942.

This paper, which is the continuation of a series [*R.A.E.*, B **7** 139, etc.], comprises records of *Aëdes aegypti*, L., from Fremantle in Western Australia and six localities in New South Wales that constitute the southern limits of its range, and of *Anopheles punctulatus* var. *moluccensis*, Sw. & Sw. [*cf.* **18** 135] from three places in Queensland. The latter was taken at Cairns and Innisfall with *A. amictus*, Edw., and small numbers of *A. annulipes*, Wlk.; characters are given distinguishing it from *A. amictus*.

SEBASTIAN (V. O.). **On the Role of *Etroplus suratensis* (Bloch) and *Etroplus maculatus* (Bloch) in the Control of Mosquitoes.**—*J. Bombay nat. Hist. Soc.* **43** no. 2 pp. 271–273. Bombay, 1942.

Having observed in Cochin that *Etroplus suratensis* would snap at any object thrown into the water in its vicinity and concluded that it would similarly attack mosquito larvae even though it did not swallow them, the author made experiments with *E. maculatus*, and found that when larvae were thrown into the water the fish became very active and began to prey on them, often snapping at one and rejecting it several times before actually swallowing it. Some larvae were killed and not swallowed. He concludes that a study of stomach contents alone is not sufficient to show the larvicidal value of fish and that their feeding habits also should be taken into consideration.

NADARAJAH (V.). **Epidemiology and Vital Statistics.**—*35th Rep. med. Offr Hlth Colombo 1940* pp. 6–10. Colombo, 1942.

Larvae of eight species of *Anopheles* were found in 495 of 2,450 potential breeding places examined in Colombo in 1940. A list shows the numbers of each; they did not include *A. culicifacies*, Giles, the vector of malaria in Ceylon.

FROHNE (W. C.). **Reconnaissance of Anopheline larval Habitats and characteristic Desmids of the Okefenokee Swamp, Georgia.**—*Publ. Hlth Rep.* **57** no. 33 pp. 1209–1217, 15 refs. Washington, D.C., 1942.

Collections of mosquito larvae and algae were made in 1938–39 at 26 typical stations in the Okefenokee Swamp [*R.A.E.*, B **14** 197], which is free from malaria in spite of large Anopheline populations, and small catches of adult mosquitos were made at the same time in buildings and hollow trees in the vicinity. Previous findings that *Anopheles crucians*, Wied., was the only Anopheline present [*loc. cit.*] and that it entered houses freely and bit in sunshine as well as in shade were confirmed. The few larvae examined for varietal determination were all of the typical form. Larvae of all instars and pupae were generally distributed in February and March, except in open waters. Practically the whole swamp is a sphagnum bog with water having a pH of 3·7–3·9 and similar microbiota, and the species of Desmids found in it, which are discussed at some length, indicated that it is of the uncommon sphagnum type of Anopheline pond [**28** 31]. This accounts for the absence of *A. quadrimaculatus*, Say, and *A. punctipennis*, Say [*cf.* **28** 31–32], which was previously unexplained. Some forms of *A. crucians* tend to breed in highly acid waters [*cf.* **7** 47]. Four characteristic species of Desmids are proposed as indicators of the sphagnum type of pond. Isolated cypress ponds on the islands were classified as belonging to a different type tolerated by *A. quadrimaculatus*, but here, as everywhere else, only *A. crucians* was found.

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SEDDON (H. R.). **Report of the Director of Veterinary Services.**—*Rep. Dep. Agric. Qd 1941–42*, pp. 14–15. Brisbane, 1942.

Outbreaks of tick fever of cattle were reported from several centres in Queensland in 1941–42. They were usually caused by *Piroplasma* (*Babesiella*) *argentinum*, *P. bigeminum* being much less common. Two outbreaks of anaplasmosis were diagnosed, but losses were comparatively slight. Dipping in some areas was ineffective against the cattle tick [*Boophilus annulatus microplus*, Can.], which appeared to be harder to kill in these districts than in others. Promising results were obtained in northern Queensland by supplementing the dips with nicotine sulphate, which had been found helpful in Africa in similar circumstances. Measures undertaken for the control of the buffalo fly [*Lyperosia exigua*, de Meij.] include the control of movement of infested cattle and spraying them at the rail heads just before they are loaded [*R.A.E.*, B **22** 221]. Two additional spraying plants were brought into operation during the year. These measures prevented the establishment of the fly in the main fattening and dairying areas of the eastern coast, but no methods are available to control its natural dispersal. At the end of June 1942, it had spread up the Mitchell River and its tributaries to the west of Mareeba, crossed the Great Dividing Range and reached the east coast near Cooktown [*cf.* **30** 82]. Tests on the toxicity of fresh sawfly larvae, taken from the tree (as opposed to the larvae that collect around the foot of the tree and often cause the death of cattle that eat them [*cf.* **20** 83; **26** 149]), showed conclusively that larvae in all stages are poisonous to sheep. Recent evidence suggests that *Ixodes holocyclus*, Neum., which causes paralysis and death in young stock [**30** 28], may cause typical symptoms and even death in adult cattle. The stickfast flea [*Echidnophaga gallinacea*, Westw.], which had not previously been found in Queensland [*cf.* **27** 205, 249], was observed on fowls in September 1941.

JENKINS (C. F. H.) & FORTE (P. N.). **Some Poultry Pests.**—*J. Dep. Agric. W. Aust.* (2) **19** no. 2 pp. 104–115, 13 figs., 7 refs. Perth, W.A., 1942.

Notes are given on the life-histories and control of the principal Arthropods that infest poultry in Western Australia. These are *Argas persicus*, Oken, *Echidnophaga gallinacea*, Westw., and several of the usual species of mites and lice.

Annual Report for the Year 1941 of the South African Institute for Medical Research, Johannesburg.—56 pp. Johannesburg [1942].

This report includes an account of investigations on mosquito repellents (pp. 18–20) made under the direction of B. De Meillon. In all trials, an arm smeared with the substance to be tested was exposed to starved and caged females of *Aëdes aegypti*, L. The most effective repellent was obtained in attempts to fix the odour of citronella and consisted of a solution of 7 parts coumarin and 5 parts gum benzoin in 88 parts citronella; it was not irritant even in the presence of small abrasions and was repellent for 3–4 hours on the arm and for 5 hours when sprayed on a guineapig but not rubbed in. It was not tested for longer periods. Further experiments were then made with coumarin, which was repellent in itself. Not more than 7 per cent. could be dissolved in citronella at room temperature, but a 20 per cent. solution could be obtained in spirit and had good repellent properties. One of the best of the other solvents tried was ethylene glycol monoethyl ether, which is not repellent alone, but appeared to prevent the evaporation of the coumarin. A 20 per cent. solution in it was at least as effective as the citronella, coumarin and gum benzoin. The necessity of applying a repellent to all exposed parts of the body is emphasised.

In the section on entomology (pp. 27–29), it is reported that Anopheline larvae taken in the Nyl swamps near Potgietersrust in the Transvaal, in a climatic region in which it was thought that *Anopheles funestus*, Giles, could not occur, were found to be *A. funestus* var. *confusus*, Evans & Leeson, and larvae from eggs laid by adults taken in native dwellings nearby and identical in characters with adults reared from the larvae taken in the swamp were also of this variety, which is stated to have been known previously only from a few individuals in Southern Rhodesia [*R.A.E.*, B **23** 186, but *cf.* **25** 105]. It is comparatively abundant near the swamp. A list is given of localities in the Transvaal, Natal and Cape Province from which *Aëdes aegypti* has been recorded.

Attempts to transmit pneumococcus type II [*cf.* **24** 177], a haemolytic streptococcus and the rickettsiae of tick-bite fever [*Dermacentroxenus rickettsi* var. *pijperi*] by means of *Cimex* [*lectularius*, L.] all failed. A pathogen causing a disease resembling tick-bite fever in its reactions in guineapigs was isolated from ticks (*Amblyomma hebraeum*, Koch) collected at Lorenzo Marques on cattle near a golf course that is notorious as a source of tick-bite fever in man.

Lowenstein (O.). **A Method of physiological Assay of Pyrethrum Extracts.** *Nature* **150** no. 3817 pp. 760–762, 3 figs., 2 refs. London, 1942.

The author outlines a method of carrying out rapid preliminary tests of the relative effectiveness of pyrethrum preparations of various compositions and strengths, without the use of the extensive insect material necessary for the biological assay described by E. A. Parkin [*cf.* *R.A.E.*, A **31** 85]. It is based on the observation and recording of action potentials in the exposed abdominal nerve cord of *Blatta orientalis*, L., by means of a standard resistance capacity coupled amplifier in conjunction with an oscillograph or a loudspeaker, and was tested with a range of concentrations of 0·07–1·3 per cent. total pyrethrins in heavy oil. It appeared to be most sensitive between concentrations of 0·13 and 0·23 per cent. and showed rather poor discriminating power for concentrations above 0·33 per cent. For intact insects, a comparable critical range of concentrations seems to lie in the neighbourhood of 1·6 or 1·3 per cent. total pyrethrin content. It is thought that there is an approximate correspondence in toxic effect between a 1·6 per cent. pyrethrin solution applied externally and a 0·3 per cent. solution of the same composition applied directly to the exposed nervous system.

The advantages of this method, which, apart from its usefulness in qualitative tests, appears to be particularly suitable for the preliminary quantitative assay of relative toxicities, include the following: the test animals are easily obtainable, and ten only are necessary for each test; the exposure of the nervous system does not present any technical difficulty; the sensitivity of the method is unexpectedly satisfactory; acoustical diagnosis is sufficient to furnish a satisfactory end point at low amplification, rendering the use of an oscillograph and recording camera unnecessary; and the experimental procedure for practical testing is sufficiently simple to be carried out in a routine way by any trained biologist.

Ewing jr. (H. E.). **The Relation of Flies (*Musca domestica* Linnaeus) to the Transmission of Bovine Mastitis.**—*Amer. J. vet. Res.* **3** no. 8 pp. 295–299, 9 refs. Chicago, Ill., 1942.

Detailed accounts are given of three experiments in Delaware on the relation of *Musca domestica*, L., to bovine mastitis [*cf.* *R.A.E.*, B **28** 203]. When several hundred flies were fed for four days on skimmed milk containing viable *Streptococcus agalactiae* in very large numbers and then on sterile skimmed milk, the *Streptococcus* was present on the surface of all flies examined on the first and second days after the last infective feed and on a decreasing proportion each day

until the seventh, when it was found on 3 out of 50. It was not found on any examined on the next four days. An examination of pools of ground flies for *S. agalactiae* harboured internally showed that some of them carried it for at least 10 days, while none did so for 14 days. In the second experiment, it was found by swabbing that *S. agalactiae* and pathogenic staphylococci were present immediately before milking at the external surface of the teat sphincters of 35 out of 41 udder quarters from which the organisms were being shed in the milk, but the colonies were not numerous. Flies feeding at the teat sphincters would not come into contact with so large a number of bacteria as those used in the first experiment. Results of swabbing after machine milking and stripping were all negative. The third study concerned the occurrence of *Streptococcus agalactiae* and pathogenic staphylococci in and on *M. domestica* trapped alive in a dairy barn housing 27 cows having mastitis caused by *Streptococcus agalactiae*, 3 others having mastitis caused by staphylococci and 35 free from infection. None of the 2,629 flies examined externally carried *Streptococcus agalactiae*, and only 5 carried pathogenic staphylococci ; none of the 1,100 examined internally carried either. Flies were seldom seen feeding at the teat orifice, and there was little or no milk on the floor. If milk containing viable agents of mastitis were present on the floor and bedding, the likelihood of transmission would be greatly increased. The practice of keeping cows on pasture in summer and bringing them in only for a short time for milking and the common use of fly sprays in dairy barns both reduce the chance of transmission of mastitis by flies.

[DERBENEVA-UKHOVA (V. P.).] **Дербенева-Ухова (В. П.). Sur l'écologie des mouches de fumier à Kabarda.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 323–339, 7 graphs, 15 refs. Moscow, 1940. [Recd. 1943.]

A detailed account is given of investigations carried out in 1938 and 1939 in three villages in Kabarda (Central Caucasus) on the breeding places and habits of flies, with a view to organising control measures.

Different kinds of dung, human faeces and kitchen refuse were examined, and the 15 species of which larvae were found and their frequency in the various media are shown in tables. Larvae of *Musca domestica*, L., were the most numerous. They were very common in large accumulations of horse dung in stables, abundant in pig dung and kitchen refuse, and rare in cow dung [*cf. R.A.E.*, B **22** 231]. Sheep dung was infested only in animal quarters in which it had been trodden over and mixed with urine. No larvae of *M. domestica* were found in human faeces, possibly because they were destroyed by those of *Fannia scalaris*, F., and *Ophyra leucostoma*, Wied., which were abundant in the latrines. Contrary to observations by other workers, horse dung became infested only while it was fresh, and it did not attract the flies after it had been removed from the stables and piled in heaps outside them. The temperature of the dung in the stables was about the same as that of the air (19–28·5°C. [66·2–83·3°F.]), whereas that of the heaps outdoors, in which larval development was completed, was much higher owing to fermentation. In warm weather the larvae occurred within about an inch of the surface of the heap, but on cold days, when the temperature of this layer was not more than 35°C. [95°F.], the larvae concentrated at depths of 2–4½ ins., where the temperature was 39–42°C. [102·2–107·6°F.].

A simple and effective control measure was to expose the dung to the air by scattering it in a layer 2–4 ins. thick in an open space, which killed the eggs and the larvae in the first two instars within 24 hours even though the temperature was too low to dry the dung. When dung treated in this way was heaped again, it did not attract mature females, even though it was wet from rain, and there was no reinfestation. Larvae in the third instar survive airing, so that the dung should be removed from the stables and exposed daily.

Larvae of *Muscina stabulans*, Fall., often occurred in refuse in boxes and in semi-liquid faeces in latrines, and occasionally in the dung of horses and cows that had been fed on distiller's wash (a by-product in the production of technical alcohol). They were not found in pig dung. The adults were most common in latrines, probably because they feed on the faeces. *Stomoxys calcitrans*, L., bred in refuse or dung if it was mixed with decaying straw or other vegetable matter. The adults were abundant in animal quarters as long as the animals on which they fed were present and also entered houses and attacked man. Infested horse dung should be exposed to the air, as recommended against *Musca domestica*, and the straw or grass litter in cow sheds should be renewed daily.

M. larvipara, Schn. & Dzied., *M. autumnalis*, DeG., and *M. tempestiva*, Fall., all of which chiefly occurred in the fields, bred in small heaps of cow dung in pastures and cattle sheds, *M. larvipara* being by far the most common. The adults caused much annoyance to cattle and horses during the flight period of Tabanids by surrounding the wounds caused by the latter and feeding on the drops of blood that exuded. *M. tempestiva* also readily fed on human blood. *Cryptolucilia caesarion*, Mg., bred only in cow dung and was commonest in cow sheds. The adults, which apparently feed on the dung, also alighted on fresh horse manure. *C. cornicina*, F., developed only in horse dung ; it preferred small accumulations, and since these dried quickly, its larval development was protracted. The larvae of *O. leucostoma* preyed upon those of the other flies, and their abundance depended upon the availability of the latter. The adults were observed in latrines and near small heaps of faeces on the grass. One of two females dissected contained 151 eggs. Since the adults are prolific and do not frequent houses, and the larvae are predacious, this fly should be considered beneficial.

[Kuzina (O. S.).] **Кузина (О. С.). Rôle des organes sensitifs chez la** *Musca domestica* **L. dans la recherche du fumier et dans la ponte des oeufs.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 340–349, 14 refs. Moscow, 1940. [Recd. 1943.]

To ascertain the relative importance of the organs of smell, sight and taste in the finding of dung and oviposition by *Musca domestica*, L., laboratory-bred females had the third segments of the antennae removed, or glue was applied to their eyes or to the proboscis in the retracted position. These flies and equal numbers of normal ones were then kept under observation in cages containing pig and cow dung. The numbers of visits that were made to the dung and of the eggs laid are shown in tables, and the behaviour of the flies is discussed in detail. The numbers of visits paid to dung of both kinds by flies deprived of the use of eyes, antennae, eyes and antennae, proboscis, and antennae, eyes and proboscis represented 50·1, 6·5, 6·1, 44·5 and 0·8 per cent. of those of normal flies, and the numbers of eggs laid 95·1, 79·2, 52·8, 16·9 and 1·5 per cent., respectively. The numbers of visits to pig dung by treated flies of the first four groups represented 560, 103, 120 and 146 per cent. of those to cow dung, as compared with 430, 268, 365 and 299 per cent. in the controls.

The fact that the flies need to taste the dung before ovipositing on it was confirmed by confining normal females in cages containing pig dung in small dishes covered with muslin, so that the olfactory stimulus was present but the flies could not reach the dung. No eggs were laid on the muslin, but in 9 experiments out of 12 they were deposited in the milk in uncovered containers that were also placed in the cages.

It is concluded that the flies are directed to a suitable medium for oviposition almost entirely by smell, but that taste is also necessary to stimulate oviposition itself. Sight is of little importance in either connection.

[Kalandadze (L. P.) & Chilingarova (S. V.).] **Каландадзе (Л. П.) и Чилингарова (С. В.). Résultats des observations faites sur la mouche domestique** *Musca vicina* **Macq.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 350–354, 1 graph. Moscow, 1940. (With a Summary in French.) [Recd. 1943.]

Catches by means of fly-papers and fly-traps in Tiflis (Georgia) in 1937 and 1938 showed that *Musca domestica vicina*, Macq., was by far the commonest fly in inhabited houses, meat shops, bakeries, restaurants and cow-sheds [*cf.* *R.A.E.*, B **31** 26], and that *Drosophila repleta*, Woll., was the most numerous of those present in stables. From 49·5 to 72·4 per cent. of *M. d. vicina* were males. In the insectary, the life-cycle was completed in 8½–27 days, being shortest in July and August, when the temperature was highest and the humidity lowest, and longest in November. In 1938, the first active females were observed in the field on 13th April, and the first and last eggs on 25th April and 25th November. The flies fed at 12–13°C. [53·6–55·4°F.] but were inactive at lower temperatures. At the end of November, when the temperature dropped to 5–6°C. [41–42·8°F.], some of the larvae died and some pupated, but the resultant adults did not oviposit. Hibernation occurred chiefly in the adult stage, but a few larvae and pupae overwintered in débris and manure dumps. Hibernation was incomplete, since flies in unheated buildings revived and flew about when the temperature rose to 10–12°C. [50–53·6°F.] ; they did not oviposit though suitable media were present.

[Romanov (A. N.).] **Романов (А. Н.). L'écologie des mouches synanthropes du Tadjikistan méridional.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 355–363, 2 graphs. Moscow, 1940. [Recd. 1943.]

A list is given of 21 species of insects found in cow dung in June–July in fields in a district in south-western Tadzhikistan, and the frequency of their occurrence and their interrelations and habits are briefly discussed. Of the fly larvae found, 70·8 and 16·3 per cent. were *Musca larvipara*, Schn. & Dzied., and *M. tempestiva*, Fall., respectively, the other species in order of decreasing abundance being *Lyperosia* sp., *L. irritans*, L., and *Dasyphora hirsutomaculata*, Macq. (*saltuum*, Rond.). On the whole, the dung was lightly infested, so that the development of the larvae was not impeded by competition for food. Predacious beetles were scarce, and, owing to the hot dry weather, no fungous diseases developed. These climatic factors checked the increase of the fly population, however, as the surface layer of the dung dried out in 2–3 hours and the flies were able to reproduce in it only while it remained fresh. The temperature of the dung changed greatly at different times of the day, varying from 18 to 46·5°C. [64·4–115·7°F.], and larval development in it was completed in 2 days by *M. larvipara* and 2½–3 days by *M. tempestiva* and *Lyperosia*. Cow dung in the fields gave rise only to flies associated with cattle, whereas that near dwellings also produced *M. domestica vicina*, Macq.

[Vaĭnshtein (B. A.) & Rodova (R. A.).] **Вайнштейн (Б. А.) и Родова (Р. А.). Les lieux de développement des mouches de fumier dans les conditions du Tadjikistan montagneux.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 364–368. Moscow, 1940. [Recd. 1943.]

Investigations in a mountain village in central Tadzhikistan, where cattle were scarce, sheep were away on their summer pastures, and kitchen refuse usually dried quickly on the ground or was thrown into the river, showed that flies were not numerous. No larvae occurred in goat dung and very few were found in horse dung, probably because it dried quickly. The chief breeding places were human faeces. A list is given of the 13 species that were bred from

different kinds of dung and of 4 other species that were caught as adults. The commonest were, in order of descending abundance, *Sarcophaga* (*Ravinia*) *striata*, F., *Musca vitripennis*, Mg., *M. larvipara*, Schn. & Dzied., *M. autumnalis*, DeG., and *M. sorbens*, Wied. All of them bred in pig dung, *M. vitripennis* and *M. larvipara* also in cow and donkey dung, and *M. autumnalis* in cow dung. *Sepsis violacea*, Mg., the numbers of which were not estimated, also occurred frequently, and bred in cow and horse dung. *M. domestica vicina*, Macq., which was comparatively scarce, and *Stomoxys calcitrans*, L., which was common, bred in pig sties in the trodden dung mixed with the litter, and the former also in human faeces.

[MEVZOS (M. P.).] **Мевзос (М. П.). Mesures antipaludiques dans la construction du grand canal de Ferghana de Staline.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 384–391, 3 graphs. Moscow, 1940. [Recd. 1943.]

In 1939, a large irrigation canal was constructed between June and December in the region of the upper Suir-Dar'ya (eastern Uzbekistan), and the measures that were adopted with considerable success to reduce the spread of malaria among the workmen engaged are reviewed. The canal is 170 miles long and passes through a densely populated area with numerous rice-fields as well as swamps and reservoirs, all of which are infested with Anopheline larvae. Most of the excavation work was carried out in August and September, which is the season when the incidence of malaria reaches its peak in Uzbekistan. The Anophelines that were observed in those months were *Anopheles pulcherrimus*, Theo., and *A. hyrcanus*, Pall., which were in general the commonest, and *A. maculipennis* var. *sacharovi*, Favr, and *A. superpictus*, Grassi, which were the most numerous away from the rice-fields. The measures taken comprised regular medical treatment of the workmen, the distribution of mosquito nets, the application of larvicides over an area of 60 square miles by aeroplane and over smaller areas by hand, and periodical drainage of rice-fields.

[LAPUISHEV (D. A.).] **Лапышев (Д. А.). Sur la parasitologie de "creeping disease" en Sibérie.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 392–400, 3 figs., 50 refs. Moscow, 1940. (With a Summary in French.) [Recd. 1943.]
[SEMENOVA (N. E.).] **Семенова (Н. Е.). Un cas de "creeping disease."** [*In Russian.*]—*T. c.* p. 401, 1 fig.

In the first paper, a detailed account is given of five cases of subcutaneous myiasis of the face and one of the finger observed in 1930–39 in western Siberia. In each case only one larva was present. Four of them, including the one from the finger, were extracted and proved to be first-instar larvae of *Gastrophilus intestinalis*, DeG. Since in all the facial cases there was close contact with horses, the author suggests that the newly-hatched larvae may have been carried from horses to the face by the patients themselves, especially as two of the latter recorded a definite sensation of stinging prior to the development of the myiasis.

In the second paper, a case is described of myiasis on the abdomen and chest of a young boy who lived near Moscow and had close contact with horses. Attempts to remove the larva were unsuccessful.

[MIRONOV (V. S.).] **Миронов (В. С.).** *Acorus calamus* **utilisé comme préparation à action insecticide et repoussante.** [*In Russian.*]—*Med. Parasitol.* **9** no. 4 pp. 409–410. Moscow, 1940. [Recd. 1943.]

The rhizomes of sweet-rush (*Acorus calamus*), which grows in damp ground in various parts of the Russian Union, contain an essential oil and are reputed to have insecticidal constituents. In experiments in Moscow, a powder of the

dried rhizomes applied freely as a dust killed adults of *Anopheles maculipennis*, Mg., and *Musca domestica*, L., within 40 minutes, but was not very toxic to *Ixodes ricinus*, L., and was ineffective against *Ornithodoros* spp. Both the dust and extracts of it made with water or alcohol repelled *I. ricinus*, and examples placed in a ring of the powdered or finely chopped rhizomes did not cross it. They were also repelled by the dry residue left on glass after the application of the aqueous or alcoholic extracts. A piece of fabric impregnated with an alcoholic extract and attached to the sleeve at some distance from the wrist prevented the ticks from crawling up any further, even when the fabric had been impregnated 2–3 days previously, and they would not cross a narrow strip of impregnated fabric in order to reach the skin. Observations in the Ussuri region showed that mosquitos did not oviposit among growths of sweet-rush, which may have been due to its repellent effect.

Powders and extracts of sweet-rush are harmless to man and animals, as mice fed on the plants or kept in the powder were not affected. The extract might therefore be used to impregnate the collars and wristbands of protective overalls in localities in which ticks occur [*cf.* *R.A.E.*, B **27** 70].

Siddons (L. B.) & Roy (D. N.). **On the Life History of** *Synthesiomyia nudiseta* **van der Wulp (Diptera, Muscidae), a Myiasis-producing Fly.**—*Parasitology* **34** no. 3–4 pp. 239–245, 19 figs., 18 refs. London, 1942.

Synthesiomyia nudiseta, Wulp (*brasiliana*, Br. & Berg.) has a wide distribution in the warmer parts of the world. It is known to breed in a variety of animal and vegetable materials and is reported to cause secondary myiasis in man and to disseminate the eggs of *Dermatobia hominis*, Say [*cf.* *R.A.E.*, B **6** 130]. It is an infrequent domestic fly in Calcutta. During an extensive survey of the breeding habits of flies there, it was bred once only, from kitchen refuse. The egg, three larval instars and puparium, which is enclosed in a cocoon consisting of sand grains cemented together with a frothy secretion, are described, and an account is given of observations on its life-history made in a laboratory in Calcutta in 1938. A female caught on 19th August laid 255 eggs on slightly putrid meat [*cf.* **29** 86] on the following morning. The eggs had not hatched by 4 p.m. on the same day, but second-instar larvae were observed in the morning on 21st and third-instar larvae on 22nd. Pupation took place on 28th, and adults of both sexes emerged on 4th September. The interval between the laying of the first and second batches of eggs by another female was 5 days. It appears, therefore, that the cycle from egg to egg occupies 20 days in summer in Calcutta.

Johnson (C. G.) & Mellanby (K.). **The Parasitology of human Scabies.**—*Parasitology* **34** no. 3–4 pp. 285–290, 3 graphs, 5 refs. London, 1942.

The salient features of the results of this investigation have been noticed from a summary [*R.A.E.*, B **31** 65], but it is here shown that the average number of adult females of *Sarcoptes scabiei*, DeG., per man was only 11·3 and less than 9 per cent. of the men had more than 30. It was also found that so-called severe cases of scabies, with numerous follicular pustules and boils, may have very few mites, whereas cases with little secondary infection may have many. The 886 men examined comprised 585 who had detected symptoms that had caused them to report sick and 301 in whom scabies was diagnosed at routine medical inspections. There was no significant difference in the parasite rates in these two groups. Some of the men stated that they had no unpleasant irritation, whereas others reported having experienced irritation for periods as long as 12 weeks. There were no significant differences in the parasite rates of men who had experienced irritation for 1, 2, 3 or 4 weeks or longer.

Roy (D. N.) & Ghosh (S. M.). **Further Work on the comparative Efficacy of different Culicifuges under Laboratory Conditions.**—*Parasitology* **34** no. 3–4 pp. 291–294, 8 refs. London, 1942.

Information is given in tabular form on the repellent action against *Aëdes aegypti*, L., and *Armigeres obturbans*, Wlk., of preparations and substances often recommended as mosquito repellents and not dealt with in a previous paper [*R.A.E.*, B **31** 35]. Tests were also carried out with hungry females of *Aëdes aegypti* to determine the extent to which some of them deteriorate in two weeks when stored in ordinary glass phials on the laboratory bench. It is concluded that any preparation containing pyrethrum extract will afford considerable protection, but this substance deteriorates considerably. Bamber oil ($1\frac{1}{2}$ parts citronella oil, 1 part liquid paraffin or kerosene, 2 parts coconut oil and 1 per cent. carbolic acid) is quite stable, but its period of effectiveness is short.

Robinson (G. G.). **Fertility in the Argasid Tick,** *Ornithodorus moubata,* **Murray.**—*Parasitology* **34** no. 3–4 pp. 308–314, 12 refs. London, 1942.

An account is given of experiments on the fertility of *Ornithodoros moubata,* Murr., designed to ascertain the best method of breeding to obtain stocks for tests of insecticides. No attempt was made to investigate aspects of the subject that had no immediate practical application. It was found that the fertility of the eggs decreases from the first to the third batch [*cf. R.A.E.*, B **13** 48] and that the decrease is significantly greater when the females have paired only once than when they have paired before each meal. Of ticks fed eight weeks after emergence, those that had paired just after emergence laid a higher percentage of sterile eggs than those that had paired the day before feeding. The significance of this is discussed. Further observations showed that eggs laid by ticks in which the organ of Géné does not function normally shrivel soon after deposition and do not develop. When kept at a relative humidity of 80 per cent. [*cf.* **27** 260], eggs developed equally well at all temperatures between 22 and 32°C. [71·6 and 89·6°F.], but none developed at 34·5°C. [94·1°F.]. The rapidity of development at 30°C. [86°F.] makes this preferable to a lower temperature for breeding a large stock. Keeping females on filter paper instead of on sand $\frac{1}{2}$ cm. deep somewhat retarded the onset of oviposition and greatly reduced the average number of eggs per female. A summary is given, based on these results, of the requirements for maximum egg-production under laboratory conditions. The study has revealed a great variability in the reproductive potential of different females.

Adler (S.) & Ashbel (R.). **The Behaviour of** *Spirochaeta persica* **in** *Pediculus humanus.*—*Ann. trop. Med. Parasit.* **36** no. 3 pp. 83–96, 11 refs. Liverpool, 1942.

Relapsing fever caused by *Spirochaeta persica* is endemic in Palestine, and infections are usually the result of visits to caves infested with *Ornithodoros tholozani*, Lab. & Mégn. (*papillipes*, Bir.) [*cf. R.A.E.*, B **25** 180]. However, cases have occurred under conditions that suggest that it may be transmitted by lice. Nicolle & Anderson consider that *S. recurrentis* (*obermeieri*) was evolved from tick-borne strains of spirochaetes [*cf.* **16** 51, etc.], which, after continued passage through lice (*Pediculus humanus*, L.) and man, lost the power to develop in ticks. The relationship between tick-borne and louse-borne strains is discussed, and an account given of experiments designed to show whether strains derived from persons who became infected in the Old City quarter of Jerusalem could have been transmitted by lice. Head lice [*P. h. capitis*, DeG.] from one patient caused infection when inoculated into guineapigs, but the strain of spirochaetes obtained was transmissible by *O. tholozani* in the laboratory and not by body or head lice. It is concluded that the presence of this

strain in the lice was of no biological significance. The same strain was rapidly destroyed in *Pedicinus eurygaster*, Burm. In one experiment in which individuals of this louse were removed from a heavily infected monkey and immediately injected into another, the latter became infected, but in similar experiments with guineapigs, the results were negative.

Susceptible animals were not infected by injection of body lice (*Pediculus humanus*) that had fed on monkeys infected with three strains of spirochaetes from two other patients, one of whom had been infected in the Old City quarter, but several lice fed on a monkey infected with a strain from another patient who acquired the infection there contained infective spirochaetes up to 10 days after feeding, though negative results were obtained with other lice. Spirochaetes of the three strains that died out within 24 hours of ingestion by lice survived up to 24 hours, 3 days, and 7 days, respectively, when injected into the coelom, and the one that survived up to 10 days when ingested, survived up to 7 days when introduced into the coelom. In no case was multiplication observed in the coelom of the lice.

Ashbel (R.). **Observations on some Strains of** *Spirochaeta persica* **in Palestine.**—*Ann. trop. Med. Parasit.* **36** no. 3 pp. 97–101, 5 refs. Liverpool, 1942.

No immunological changes in *Spirochaeta persica* were observed as a result of repeated passages through rats and guineapigs, but mutations did occur as a result of passage through man, monkeys and *Ornithodoros tholozani*, Lab. & Mégn. Two rats that had recovered from infection with a certain strain and been inoculated with the same strain after it had passed through a tick became infected, but two that had recovered from infection with the tick strain and been inoculated with the original strain, did not. The original strain consistently protected against itself. It was found that relapses in man can take place with or without mutation of the spirochaetes.

Lawrence (D. A.). **Tick Transmission of Disease.**—*Rhod. agric. J.* **39** no. 6 pp. 500–503, 1 fldg. table. Salisbury, S. Rhod., 1942.

This outline of the life-history of Ixodid ticks in relation to the transmission of diseases of animals includes a table showing the vectors of anaplasmosis and spirochaetosis (*Spirochaeta theileri*) of cattle, heartwater (*Rickettsia ruminantium*) and various forms of piroplasmosis, and the stages in which they acquire and transmit these infections.

Eddy (G. W.). **Notes on the seasonal History of the Rabbit Tick,** *Haemaphysalis leporis-palustris*, **in Oklahoma.**—*Proc. ent. Soc. Wash.* **44** no. 7 pp. 145–149, 1 map, 9 refs. Washington, D.C., 1942.

Notes are given on the importance of *Haemaphysalis leporis-palustris*, Pack., as a vector of tularaemia and Rocky Mountain spotted fever, its distribution in America and in Oklahoma and its hosts. It chiefly infests rabbits and hares, but birds are also important hosts of the immature stages, and the author has collected larvae and nymphs in Oklahoma from various other rodents, skunk and domestic cat. To determine its seasonal distribution in Oklahoma, 5–32 cottontail rabbits (*Sylvilagus floridanus alacer*) were collected each month in Payne county throughout 1939. Ticks were found on them in every month, the average number per rabbit varying from 2·80 in December to 115·56 in June. Larvae and nymphs were taken in all months, but no adults were taken in December and very few in November, January and February. These findings are compared with those of other workers in the United States.

Komp (W. H. W.). *Anopheles clarki*, **a new Species of** *Nyssorhynchus* **of wide Distribution in South America (Diptera: Culicidae).**—*Proc. ent. Soc. Wash.* **44** no. 9 pp. 196–201, 4 figs., 5 refs. Washington, D.C., 1943.

Descriptions are given of the adult female and male terminalia of *Anopheles* (*Nyssorhynchus*) *clarki*, sp. n., based on specimens from the type and another locality in the Province of Tucumán, Argentina, and from Bahia, Ceará and Alagôas, Brazil. The females closely resemble others of the *tarsimaculatus* series of Edwards [*R.A.E.*, B **29** 177, 181], and the males are indistinguishable from other members of the series except on the basis of the terminalia. The need for reconsidering all conclusions on the biology and ecology of the species of the subgenus *Nyssorhynchus* in these and other areas of South America and their importance as vectors of malaria in the light of the discovery of this new species is pointed out.

Rees (D. M.). **Overwintering Habits in Utah of** *Anopheles maculipennis freeborni* **Aitken (Diptera : Culicidae).**—*Ent. News* **53** no. 10 p. 282. Philadelphia, Pa., 1942.

In observations on the overwintering habits of *Anopheles maculipennis* var. *freeborni*, Aitken, made annually in and near Salt Lake City since 1928, females were seen in rock cellars, potato pits, granaries, garages, stables and other outbuildings, particularly in protected dark corners and on cobwebs in warm, dark, unoccupied shelters. They were collected during all the winter months, sometimes when the outside temperature was below 0°F. Hibernation was not complete, as they would fly short distances when disturbed, but they were never induced to feed in their shelters, though they sometimes fed and oviposited in the laboratory. They left their shelters during the latter part of April or in May.

Lever (R. J. A. W.). **The malarial Mosquito of Melanesia.**—*Agric. J. Fiji* **13** no. 4 pp. 116–117, 14 refs. Suva, 1942.

Notes are given on the breeding places of *Anopheles punctulatus*, Dön., the vector of malaria in Melanesia, which is found in the Solomon Islands and New Hebrides, but is not known to be present in Fiji. Within its area of distribution [*cf. R.A.E.*, B **30** 186], Belep alone is free of it, while malaria occurs in Aneityum, just south of 20° S. lat. The Anopheline and malaria first appeared in Rennell between 1933 and 1937. As its larvae have been taken in widely differing kinds of water and even in hot springs, it could easily find suitable breeding places in Fiji, and the utmost vigilance to prevent its becoming established is necessary, particularly in view of the fact that the chief form of malaria in the Solomon Islands is malignant tertian [*Plasmodium falciparum*].

Esaki (T.). **A preliminary Report on the entomological Survey of the Micronesian Islands under the Japanese Mandate, with special Reference to the Insects of economic Importance.**—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 407–415. Berkeley, Calif., 1940. [Recd. 1943.]

This paper is compiled from observations made in 1936 and 1938, and much of the information in the section on Arthropods of medical importance has already been noticed [*R.A.E.*, B **27** 256]. Apparently no dangerous mosquito-borne diseases occur on the islands, but dengue, presumably transmitted by *Aëdes aegypti*, L., or an allied species, has broken out frequently in the Palau Islands since the Japanese occupation. It is believed to have been introduced by immigrants from the Loochoo Islands. A large tick, probably *Rhipicephalus sanguineus*, Latr., is often found among weeds in the Marianne Islands. Notes are given on dermatitis caused by unidentified mites, and on bees, wasps and ants that attack man. Various species of Oedemerids of the genus *Eobia*, which cause inflammation on the skin, are abundant on all the islands.

Herms (W. B.). **Some entomological Problems of the Pacific Area with which medical Entomologists should be concerned.**—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 429–432, 7 refs. Berkeley, Calif., 1940. [Recd. 1943.]

The importance of the correct identification of Arthropods in medical entomology and the need for workers with a thorough knowledge of field ecology and the care of experimental animals is stressed. It is pointed out that the Pacific area with its wide range of climatic conditions, varied fauna and parasitic infections, and numerous races of man presents great scope for study, and special problems requiring attention on the Pacific coast of the United States and Mexico are reviewed.

Stewart (M. A.). **Present Knowledge of the Status of Vectors of sylvatic Plague in North America.**—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 433–437, 6 refs. Berkeley, Calif., 1940. [Recd. 1943.]

The following is based on the author's summary. The presence of sylvatic plague has been demonstrated in California, Oregon, Washington, Idaho, Nevada, Utah and New Mexico in North America, and 21 species of rodents have been found with anatomical lesions or bearing infected fleas [*cf. R.A.E.*, B **28** 27]. As the most widely distributed fleas among these rodents are *Ceratophyllus* (*Diamanus*) *montanus*, Baker, *C.* (*Oropsylla*) *idahoensis*, Baker, and a subspecies of *C.* (*Orchopeas*) *sexdentatus*, Baker, it is considered that their efficiency in transmission should be studied first [*cf.* **30** 33]. Investigation is also required on the part played by *Echidnophaga gallinacea*, Westw. [*cf.* **30** 37] and *C.* (*Malaraeus*) *telchinum*, Roths., in spreading the disease between domestic and wild rodents, as they occur on both. The latter is the more active and therefore probably the more important [but *cf.* **30** 33]. The incidence of lesions in susceptible wild rodents is usually high in autumn, and their flea indices increase markedly at this time. The flea population of wild rodents is apparently more or less constant for each season, and a host freed of its fleas will very quickly acquire a normal infestation. Rodent poisoning does not increase the flea index on surviving animals and consequently does not increase the rate of infection. Wild rodents apparently acquire infection by ingesting infected fleas or rubbing infected fleas and rarely faeces into skin wounds, by the bites of fleas with contaminated mouth-parts, by the bites of infective, blocked fleas, and by eating one another. The part played by fleas in the transmission of plague from wild rodents to man is not understood. A number of cases of human infection have been traced to bites by captive, wild rodents.

Howell (D. E.). **The Ecology of** *Dermacentor albipictus* (**Packard**).—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 439–458, 9 refs. Berkeley, Calif., 1940. [Recd. 1943.]

Dermacentor albipictus, Pack., a one-host tick of which the usual hosts are horses, cattle, the moose and other deer, occurs in localised areas over most of the southern part of Canada and the north of the United States and southwards along the mountain ranges to Mexico. In California, the larvae are found in winter hanging head downwards on blades of grass or weeds growing on rolling hills sparsely covered with shrubs, and they may occasionally be found in summer clustered at the foot of bushes. Weekly observations on horses from heavily infested pastures near San Francisco Bay showed that the ticks occurred on them only between late August and March and there were three peaks of prevalence during this period. These could not be correlated with weather. Larvae that hatched in March and were placed on cattle, horses and other animals refused to feed until mid-September. When some of them were placed

on a bull on 27th September, nymphs were first seen on 7th October, adults on 17th October (the males emerging slightly before the females) and replete females on 27th October. Oviposition began early in November and hatching a month later. The newly-hatched winter larvae fed, but not so readily as those that had had a long resting period.

The larvae feed chiefly around the tail and the lower part of the neck of the host. Animals in poor condition pick up the largest numbers. The larvae required an average of 9 days to feed to repletion and 11 days to moult. Unfed larvae that had hatched in April lived 9–10 months. Nymphs fed to repletion in about 7 days and required 5–7 days between repletion and the completion of moulting. Unfed nymphs lived for 10–101 days, under laboratory conditions, but more than 80 per cent. were dead 56 days after moulting. The distribution of nymphs on the host is far more general than that of larvae. Adult females were replete 5–14 days after attachment (the greatest number on the eighth day) and began to oviposit about 17 days and died 1½–2½ months after becoming replete. Adult males feed for only a short period and never become visibly replete. Twenty-five females laid an average of 3,835·5 eggs each during a period of 35 days. The egg stage lasted 20, 29, 36 and 56–60 days at 35, 30, 25 and 20°C. [95, 86, 77 and 68°F.], respectively. Very little embryonic development occurred at 15°C. [59°F.]. The newly hatched larvae are sensitive to desiccation, but become much more resistant within 2–3 hours. They are inactive for 2 or 3 days, after which they migrate a little although they still cluster together, separating when disturbed, but reassembling later. Ticks in all stages of development preferred a relative humidity above 70 per cent. and many chose one over 85 per cent. Relative humidities below 60 per cent. were not favourable for egg development, and the largest larvae were developed from eggs kept at 80 per cent. relative humidity. This was also the most favourable humidity for longevity. A temperature of 35°C. produced the largest larvae, but the life span was greatest at 20°C. Light had little or no influence on activity.

Usinger (R. L.). **Distribution and Host Relationships of North and Central American Triatominae.**—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 459–461. Berkeley, Calif., 1940. [Recd. 1943.]

The author shows how, as a result of recent systematic work, the Triatomids of North and Central America can be divided into natural groups, which may be genera or subdivisions of genera and some of which are distinguishable by distribution and host relations.

Whitehead (W. E.). **Lice and some other external Parasites of Domestic Animals and Poultry in the Province of Quebec.**—*Farm Bull. Macdonald Coll. P. Q.* no. 7, 27 pp., 49 figs. [Quebec] 1942.

The habits of lice and methods for their control are reviewed, and characters are given for distinguishing Mallophaga from Anoplura, together with diagrams for the identification of the various species that occur on domestic animals and poultry in the Province of Quebec. Fleas and the mites that attack fowls are similarly but more briefly dealt with. It is pointed out that the dog flea, *Ctenocephalides canis*, Curt., is the principal flea attacking man in Quebec. *Pulex irritans*, L., occurs only seldom [*cf. R.A.E.*, B **24** 43], usually on pigs.

Roubaud (E.) & Grenier (P.). **Quelques observations sur l'aliment des larves de culicides (facteurs B et substances protéiques).**—*Bull. Soc. Path. exot.* **35** no. 6–8 pp. 215–219, 1 graph, 5 refs. Paris, 1942.

In experiments in which wheat flour (81·5 per cent. extraction) or mixtures containing it were used as food for mosquito larvae, *Theobaldia annulata*, Schr.,

developed most quickly and the percentage of adult emergence was greatest when a mixture of wheat flour and purified casein was used. With this mixture, the average length of the larval stage was 14 days, the larvae were strong and active and moulted almost simultaneously, and bacterial development in the water was not unduly stimulated. When substances rich in vitamin B (dry yeast or yeast autolysate) were added to the mixture, the duration of the larval stage was not affected, but bacterial development was excessive and mortality of larvae was sometimes considerable. Larvae given flour alone developed much more slowly, the resulting adults were smaller, and the mortality was higher than on flour and casein. Tests with *Culex pipiens pipiens*, L., gave substantially the same results. Experiments with *Anopheles maculipennis* var. *atroparvus*, van Thiel, were inconclusive, owing to heavy mortality in the early instars. It is concluded that wheat flour contains enough vitamin B for larvae of *Theobaldia* and *Culex*, but supplementary protein should be given. This was verified when soy-bean flour, which is much richer in protein than wheat flour, was found to be an optimum food for larvae of *Culex* and *Aëdes aegypti*, L.

NICOLLE (P.) & LWOFF (M.). **Recherches sur la nutrition des réduvidés hémophages. I. Développement des stades larvaires de *Triatoma infestans* Klug dans les conditions habituelles d'élevage.**—*Bull. Soc. Path. exot.* **35** no. 6–8 pp. 219–232, 7 graphs, 12 refs. Paris, 1942.

The authors intend to publish a series of papers on studies of the nutrition of Triatomids made to ascertain the part played by the various constituents of the ingested blood in the development of the insect and the vitamins that are necessary in the food. Nicolle's apparatus [*R.A.E.*, B **30** 178] was used for feeding, but *Triatoma infestans*, Klug, was also bred in natural conditions on guineapigs for comparison, and this paper deals exclusively with nymphal development under these conditions, observed between 31st March and 16th September 1941. Nymphs of the first two instars were kept at 23–24°C. [73·4–75·2°F.] and those of the last three at 26°C. [78·8°F.]. This change in temperature resulted in some inconsistency in the duration of the instars. Feeds were given every four days, as this was found to be the period necessary for excretion to be completed. The data given include the weight before and after each moult and before the first feed in each instar, and the quantity of blood taken and of matter excreted during each instar. The number of feeds in each instar, the average weights before and after each meal and on each day during excretion, and the days on which moulting occurred and the percentage of nymphs that moulted on each are shown in graphs.

PHILIP (C. B.). **Mechanical Transmission of Rabbit Fibroma (Shope) by certain haematophagous Bugs.**—*J. Parasit.* **28** no. 5 pp. 395–398, 3 refs. Lancaster, Pa., 1942.

Rabbit fibroma was transmitted to domestic rabbits by the completion of interrupted feeding of mixed batches of Triatomids (*Triatoma infestans*, Klug, *T. protracta*, Uhl., and *Rhodnius prolixus*, Stål) and by injection of visceral contents of some of these bugs. They had been fed immediately before on an active fibroma on an artificially infected rabbit. The results of feeding tests with bugs stored at laboratory temperature for 12, 15 and 70 days after feeding fully and simultaneously on an infective animal were negative, as was that of a test of injection on the 71st day. Triatomids are not known to infest rabbit warrens in the eastern United States where the disease is endemic, but the fact that the lesions frequently occur on the legs and haunches suggested that it might be carried by some Arthropod living in the nests or warrens.

SPRAGUE (V.) & RAMSEY (J.). **Further Observations on *Plistophora kudoi*, a Microsporidian of the Cockroach.**—*J. Parasit.* **28** no. 5 pp. 399–405, 1 pl., 8 refs. Lancaster, Pa., 1942.

Of 52 adults of *Blatta orientalis*, L., of both sexes collected in West Virginia and Kentucky in May and June 1941, 39 contained *Plistophora kudoi* in the epithelial cells of the caeca and mid-gut. In cases of heavy infection, these cells are often greatly hypertrophied and sometimes slough off, so that large areas of the epithelium become severely damaged. No other effects, either microscopic or macroscopic, were seen, and it is not known whether infection is ever fatal to the host. The spores and certain developmental stages of the microsporidian are described. The only other *Plistophora* known to occur in *B. orientalis* has a different site of infection and much larger spores. These and other morphological differences are considered to justify the conclusion that *P. kudoi*, which was described in a preliminary note by the authors in 1941, is distinct from it.

LAUDINI (H.) & SWEETMAN (H. L.). **Roach Control. A Study of the relative Efficiency of various commonly used Insecticide Dusts against Roaches.**—*Soap* **17** no. 6 pp. 129–131, 133, 135. New York, N.Y., 1941. [Recd. 1943.]

The experiments here described on the toxicity of various common insecticides to *Periplaneta americana*, L., and *Blattella germanica*, L., were carried out either by making the cockroaches pass through a covered runway 14 ft. long and 2 ins. wide and deep, on the bottom of which the dust had previously been evenly sprinkled, or by dusting them in gauze cages. A heavier and better distributed deposit was obtained by the second method. All tests were carried out at room temperature and humidity.

In runway tests with *P. americana*, the percentages dead after 7 days were 79 for sodium fluoride, 45 for pyrethrum, 75–100 for sodium fluoride and pyrethrum in proportions varying from 9 : 1 to 2 : 1, 38 for rotenone, 8 for sodium fluosilicate, 29 for borax, and 50 and 88 for pyrethrum and borax at 3 : 1 and 1 : 1, but borax gave complete mortality in 14 days. The average numbers of hours in which death occurred were 87, 34, 42–107, 37, 112, 127, 68 and 86, respectively. The cockroaches showed no immediate ill-effects after passing over sodium fluoride, but reaction was immediate after they had passed over pyrethrum. The percentages of *P. americana* killed in 3 days as a result of being dusted were 80 for sodium fluoride, 100 for pyrethrum, 63–100 for sodium fluoride and pyrethrum in proportions varying from 1 : 1 to 9 : 1, and 67 for sodium fluosilicate, and the hours taken to kill averaged 25, 29, 15–29 and 46, respectively.

In the runway tests with *B. germanica*, the mortality percentages in 7 days were 100 for sodium fluoride, 13 for pyrethrum, 100 for all but one of various mixtures of sodium fluoride and pyrethrum, 83 for sodium fluosilicate, 67 for rotenone, 83 for borax and 100 for equal parts of pyrethrum and borax. The hours to kill averaged 32, 101, 17–49, 71, 73, 83 and 117, respectively. The percentages of *B. germanica* killed in 7 days after being dusted were 100 for sodium fluoride, 89 for pyrethrum, 100 for pyrethrum and sodium fluoride in equal parts, 60 for sodium fluosilicate, and 70 for rotenone, and the hours to kill averaged 9, 29, 28, 87 and 96, respectively.

These results are compared with the published opinions of pest control operators and insecticide manufucturers as to the values of the different dusts. The experiments with *P. americana* support the common recommendation of mixtures of sodium fluoride and 17–33 per cent. pyrethrum, which had an effect in which the rapid action of the pyrethrum was evident during the first 2–3 days and the action of sodium fluoride on subsequent days. The time required to kill and the duration of effectiveness were generally correlated with the proportions of the two ingredients.

What Specifications for Insecticide Base Oil ?—*Soap* **18** no. 11 pp. 87–90, 99. New York, N.Y., 1942.

There is no generally recognised specification for a petroleum base oil to be used in the manufacture of a liquid household insecticide (fly-spray), and it is not generally agreed that one is needed. In view, however, of interest shown in the subject and the opinion of some who buy insecticides on a large scale that such a specification is desirable, the National Association of Insecticide and Disinfectant Manufacturers decided to investigate the matter. N. J. Gothard was appointed to do so and drew up tentative specifications for both odourless and non-odourless types of spray, which are given, together with his comments on them and the comments and criticisms of a number of chemists and entomologists in the insecticide industry. After drawing up the specifications, Gothard retained the view that the value of such a standard is questionable.

Insecticides for the Army. The Aerosol Insecticide Program and its Effects on the Insecticide Industry now and after the War.—*Soap* **18** no. 11 pp. 91–93. New York, N.Y., 1942.

Cylinders containing an insecticide, which on release is expelled by gas pressure in the form of an aerosol, are being manufactured for the United States Army. The insecticide consists of enough pyrethrum extract containing 20 per cent. pyrethrins to produce a concentration of 0·4 per cent. pyrethrins, 1 per cent. sesame oil and dichlorodifluoromethane as the solvent and expelling gas. The method of mixing the dichlorodifluoromethane and insecticide has already been noticed, but the description [*R.A.E.*, B **30** 164] must be corrected, as it is the tank containing the insecticide that is placed in ice water and the tank containing the solvent that is inverted over it, so that the solvent is run into the tank of insecticide. Research is in progress on the possibility of using methyl chloride as a solvent and expellent, but it is somewhat toxic to man and domestic animals. Various diluents for dichlorodifluoromethane have been tried with apparent success. The extent to which the development of these aerosol cylinders will affect the insecticide industry and the demand that it will make on available supplies of Kenya pyrethrum are discussed.

Howell (D. E.). **The Use of Arsenicals for the Control of Housefly Larvae.**—*Proc. Okla. Acad. Sci.* **22** pp. 68–72, 13 refs. Edmond, Okla., 1942.

Following unsuccessful attempts in Oklahoma to control breeding of houseflies [*Musca domestica*, L.] by the chemical treatment of manure, 48 materials were tested on third-instar larvae in jars containing 100 gm. crimped oats, 100 gm. water and 0·3 cc. formalin. Water-soluble chemicals were dissolved in the water before it was added to the oats, and insoluble ones were finely ground and mixed with the oats before and after the addition of the water. The smallest amounts that gave 100 per cent. mortality and the average amounts that gave 50 per cent. were 40 and 12 mg. sodium arsenite, 40 and 17 mg. arsenic trioxide, 50 and 23 mg. Paris green, 50 and 24 mg. arsenic pentoxide, 80 and 28 mg. sodium arsenate, 80 and 31 mg. cupric arsenate and 90 and 37 mg. mercuric chloride. A list is given of the other chemicals tested, showing the amount that gave complete mortality unless this was above 5·0 gm. Borax, the best of these, gave complete mortality at 220 mg. It had not given satisfactory control in the field. Data on the effect of some of the chemicals on the soil are reviewed from the literature. Wetting infested manures with a 0·1 per cent. solution of commercial sodium arsenite was found to be the most satisfactory and economical chemical control measure tried. Even when all the manure has to be wetted, less than 2 lb. sodium arsenite per ton is applied, and this does not seem to harm crops. As the arsenic readily leaches out, the danger of building up a toxic concentration is slight.

Olsen (O. W.) & Fenstermacher (R.). **Parasites of Moose in northern Minnesota.**—*Amer. J. vet. Res.* **3** no. 9 pp. 403–408, 26 refs. Chicago, Ill., 1942.

Except for a single individual of *Simulium venustum*, Say, which may have occurred accidentally, the only Arthropod found in this study of the parasites on 36 whole or partial carcasses of moose (*Alces americana*) was *Dermacentor albipictus*, Pack. [*cf. R.A.E.*, B **22** 130], which occurred on 24 of the carcasses, and was taken, frequently in great numbers, in every month of the year in which moose were collected, except July. For comparison, Arthropods that have been recorded from the European elk (*Alces alces*) are reviewed.

Steinhaus (E. A.). **Note on a toxic Principle in Eggs of the Tick, *Dermacentor andersoni* Stiles.**—*Publ. Hlth Rep.* **57** no. 35 pp. 1310–1312, 2 refs. Washington, D.C., 1942.

Intraperitoneal inoculation of varying quantities of saline suspensions of eggs of normal individuals of *Dermacentor andersoni*, Stiles, into 31 guineapigs resulted in the appearance of toxic symptoms in all of them and the death of 29, and intraperitoneal inoculation of Berkefeld filtrates of such suspensions into 9 guineapigs resulted in the death of 8, but two animals into which the filtrate was injected subcutaneously survived [*cf. R.A.E.*, B **29** 158]. Six guineapigs that received suspensions of the eggs by the mouth were not affected. The reactions in the guineapigs are described. Those in rabbits and mice were similar but occurred less consistently. Repeated attempts to reproduce the conditions in fresh animals by the transfer of blood or saline suspensions of various organs were unsuccessful. Cultures of guineapig tissues usually remained sterile. Occasionally a micrococcus, which was also found on the surface of the eggs, was isolated, but cultures of it did not produce the typical reaction, whereas eggs that had been sterilised exteriorly did. The active principle did not pass through collodion or viscose membranes in eight days. It was resistant to drying, alcohol and acetone. The author is not prepared to suggest that the toxic principle in the eggs of *D. andersoni* is the one concerned in the production of tick paralysis by this tick [*cf.* **19** 180 ; **27** 149].

Brigham (G. D.) & Watt (J.). **Additional highly virulent Strains of Rocky Mountain Spotted Fever Virus isolated in Georgia.**—*Publ. Hlth Rep.* **57** no. 36 pp. 1342–1344, 2 refs. Washington, D.C., 1942.

Highly virulent strains of Rocky Mountain spotted fever virus were isolated from two young children in Georgia in 1940 [*cf. R.A.E.*, B **29** 126] and from ticks (*Dermacentor variabilis*, Say) collected on a farm where a boy had died of the disease.

Steinhaus (E. A.). **Rickettsia-like Organism from normal *Dermacentor andersoni* Stiles.**—*Publ. Hlth Rep.* **57** no. 37 pp. 1375–1377, 7 refs. Washington, D.C., 1942.

A rickettsia-like organism occurring spontaneously in the tissues of all stages of *Dermacentor andersoni*, Stiles, is described as *Rickettsia dermacentrophila*, sp. n. The ticks belonged to a strain reared in the laboratory in Montana for several years, the members of which had caused no fever in the animals on which they fed and produced no evidence of disease when injected into guineapigs. The organism could not be cultivated on artificial media, but was maintained by serial passage in incubating fertile chick eggs. It was not pathogenic to laboratory animals and various rodent hosts of *D. andersoni*, and inoculated animals did not become immune from Rocky Mountain spotted fever or American Q fever [*R. diaporica*].

Davis (G. E.). *Ornithodoros parkeri* **and Relapsing Fever Spirochetes in southern Idaho.**—*Publ. Hlth Rep.* **57** no. 40 pp. 1501–1503, 3 refs. Washington, D.C., 1942.

In June, August and September 1941, 1,566 individuals of *Ornithodoros parkeri*, Cooley, which had not previously been taken in Idaho [*cf. R.A.E.*, B **28** 28; **30** 89], were collected in the southern part of the State, and 1,298 were tested for spirochaetes by feeding them on mice in 163 batches, 69 of which gave positive results. This is the heaviest infestation of *O. parkeri* so far found in any one area, with the possible exception of an isolated one in central California [**30** 130], and the largest number of spirochaete strains recovered. Examples of this tick were collected from rodent burrows, which are numerous in the area, and there was evidence of the presence of burrowing owls [*Speotyto*] in the part most heavily infested with ticks [*cf.* **28** 137]. Relapsing fever has not been reported there.

Lindquist (A. W.) & Deonier (C. C.). **Emergence Habits of the Clear Lake Gnat.**—*J. Kans. ent. Soc.* **15** no. 4 pp. 109–120, 2 figs., 5 refs. Manhattan, Kans., 1942.

The following is based on the authors' summary of the results of studies on the emergence of *Chaoborus astictopus*, Dyar & Shann., in Clear Lake, California [*cf. R.A.E.*, B **31** 48]. Records from a line of five floating recovery cages operated from May to September inclusive in 1939 and 1940 showed that emergence occurred practically every day throughout the season, but the daily rate was irregular and ranged from less than 1 to 75 gnats per sq. ft. The average seasonal recovery per sq. ft. was 487 in 1939 and 653·9 in 1940. The two cages within three-quarters of a mile of the shore took 57·2 per cent. of the total catch in 1939 and 55·7 per cent. in 1940. Larval and pupal populations were scanty throughout the summer in the bottom mud near these cages and high farther out. Emergence was highest in the last half of July in 1939 and in the first part of August 1940. The overwintering generation continued to emerge over a period of 67 days in 1939. Large numbers of adults emerged at a water temperature of 62–70°F. in spring, but pupation and emergence in autumn were greatly reduced at 70° and nearly ceased at 65°. According to the catches in the cages, the overwintering and summer generations accounted for at least 163 and 325 adults per sq. ft. in 1939, and 127 and 535 in 1940. The total seasonal emergence from the upper, large arm of the lake (about 44 sq. miles) was estimated at about 531 thousand million or 266 tons of *C. astictopus* in 1939 and 712 thousand million or 356 tons in 1940. The percentage of females among 27,930 individuals taken was 39·8. Emergence apparently occurred between 11 p.m. and 6 a.m. Other observations indicated that emergence occurs all over the lake.

Bruce (W. G.). **Acidified Nicotine Sprays for Horn Flies on Cattle.**—*J. Kans. ent. Soc.* **15** no. 4 pp. 120–123. Manhattan, Kans., 1942.

In preliminary experiments, the addition of glacial acetic acid to solutions of nicotine sulphate stabilised them, prolonged their toxicity to *Lyperosia* (*Haematobia*) *irritans*, L., and made them less likely to harm cattle, but imparted an objectionable odour slightly repellent to the flies. The effectiveness against *L. irritans* of aqueous solutions of pure nicotine alone or combined with malic or lactic acid and nicotine sulphate alone or with glacial acetic acid was tested in 1939, 1940 and 1941. Each test animal was confined in a screened building and infested with one or more batches of 100 flies, just before or after being sprayed. Spraying with 40 ml. of a solution of pure nicotine containing 0·42 per cent. nicotine or with 50 ml. of one of nicotine sulphate containing 0·4 per cent. nicotine knocked down all flies immediately, but some recovered; 10 were alive 2 hours after the application of the former spray and 28 were alive

5 hours after that of the latter. Spraying with 30 ml. of a solution containing 5 per cent. glacial acetic acid and 0·5 or 1·0 per cent. nicotine killed all flies released before spraying and 30 or 58 per cent., respectively, of flies released an hour later. When a heifer was sprayed with 60 ml. of the latter solution and infested with batches of flies immediately and one and two hours later, only 16 flies out of 300 were alive 6 hours after spraying. Glacial acetic acid alone had no effect. Solutions of nicotine malate containing 0·5 per cent. nicotine and about 1·0 per cent. malic acid killed 98 per cent. of the flies on the animal at the time of spraying. The application of 35 ml. of a nicotine-lactate solution containing 0·42 per cent. nicotine and 0·84 per cent. lactic acid killed all flies on the animal at the time ; 340 ml. of a solution containing 0·5 per cent. nicotine and 1·0 per cent. lactic acid on an animal infested immediately after spraying and each hour afterwards for 5 hours killed all flies in the first five batches and 50 per cent. in the sixth ; and 150 ml. of a solution containing 1 per cent. nicotine and 2 per cent. lactic acid killed all flies released hourly up to 7 hours after spraying except 6 of the last batch. This solution is not repellent and did not harm the cattle. Moulds and bacteria developed in the solutions that did not contain glacial acetic acid, but this was prevented for over a year by the addition of 2 per cent. formalin.

Bequaert (J.). **The Pigeon-fly,** *Pseudolynchia canariensis* **(Macquart), in New England and New York (Hippoboscidae, Diptera).**—*Bull. Brooklyn ent. Soc.* **37** no. 5 pp. 185–186. Lancaster, Pa., 1943.

Pseudolynchia canariensis, Macq. (*maura*, Big.) was first recorded from New England in October 1932 when an adult was found at Cambridge, Massachusetts, in conditions that excluded the possibility of introduction in the adult stage. It has been seen periodically on pigeons in Boston since 1937, but in all cases, might have been imported from the south [*cf. R.A.E.*, B **18** 89 ; **29** 135]. An adult was recorded on a feral pigeon in Boston 3 or 4 years ago, some were seen on carrier pigeons in Cambridge in 1941 and 1942, and two were taken from a moribund feral pigeon in New York in 1933. It is thought to be a recent introduction in the United States, where it was first taken in 1896. It has been found in 16 States, a list of which is given, and in the District of Columbia.

Cochrane (E.). **Is** *A. argyritarsis* **a malarial Vector in Grenada ?**—*Caribb. med. J.* **3** no. 4 pp. 193–195, 4 refs. Trinidad, 1942.

The author does not accept the view that *Anopheles aquasalis*, Curry (*tarsimaculatus*, auct.) is the only important vector of malaria in Grenada [*cf. R.A.E.*, B **23** 28], though he agrees with it so far as the east coast is concerned. There the swamps that constitute the main breeding place of this Anopheline are extensive, and it and malaria are most prevalent during the last half of the year when rainfall is heaviest. The species that he considers a vector in other parts of the Island is *A. argyritarsis*, R.-D. Isolated outbreaks and sporadic cases often occur in the first half of the year in areas where *A. aquasalis* is rarely found. The outfall of a river on the west coast became blocked in 1938, and abnormally low rainfall in the first half of 1940 reduced the river to a series of shallow pools covered with algae and overgrown with vegetation. *A. argyritarsis* and *A. pseudopunctipennis*, Theo., were present in considerable numbers, but as *A. aquasalis* was absent, no control measures were taken and the incidence of malaria began to increase. Regular dipping was carried out over an area with a radius of three miles from the river pools, but *A. aquasalis* was not found. Occasional adults of *A. argyritarsis* and *A. pseudopunctipennis* were caught in early morning inspections of houses. When the river was cleared of vegetation, the larval catches fell off and the epidemic ceased, although an open drain in which larvae of *A. pseudopunctipennis* were abundant

had been left untreated as a control. This species has, moreover, been found difficult to infect in the laboratory, in contrast to *A. argyritarsis* [**23** 29]. No malaria parasites were found in 42 females of the latter and 18 of the former taken in a trap when the epidemic was practically over.

UNTI (O.). **Notas ecológicas sobre anofelinos do Vale do Paraíba.** [Ecological Notes on the Anophelines of the Parahyba Valley.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 13–21, 1 map. São Paulo, 1942. (With Summaries in English and French.)

An experiment station has recently been established at Guaratingueta on the Parahyba for the study of the problem of the absence of malaria in the presence of Anophelines, and preliminary observations were made in October and November 1939 on the character of the water in Anopheline breeding places along the river banks and in sites apparently suitable for breeding but in which no larvae were found. The Anophelines observed, which constituted 95 per cent. of all the mosquito larvae taken, were, so far as could be identified, *Anopheles albitarsis*, Arrib., *A. strodei*, Root, and *A. argyritarsis*, R.-D. The water had a very low content of chlorine from chlorides, between 3·01 and 45·8 parts per million in the breeding places and between 9·115 and 46·6 in the other sites. The water in the breeding places showed an acid reaction (pH 6·8–6), except in two cases in which it was neutral, and was positive for ammoniacal nitrogen in all the cases investigated. Most of the larvae were found in very shallow water that contained much organic matter, including excreta of horses, cattle and fowls, luxuriant aquatic vegetation of the genera *Eichhornia* and *Salvinia*, plankton, many fish, and few algae. Notes on meteorological conditions are included.

CORRÊA (R. R.). **Das formas evolutivas aquáticas do** *Anopheles* (*Anopheles*) *eiseni* **Coquillett, 1902.** [On the aquatic evolutional Forms of *A. eiseni*.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 25–28, 3 pls., 3 refs. São Paulo, 1942.

The egg, larva and pupa of *Anopheles eiseni*, Coq., are described from material obtained at Guarujá in the State of São Paulo. The larvae were found in springs and clear streams in forests and were seldom taken in the breeding places of other Anophelines. Over 7,000 were collected, but the adults were difficult to find ; only two adults were taken among 920 Anophelines caught in various ways.

CORRÊA (R. R.) & [DA] S[ILVA] RAMOS (A.). **Os anofelinos da região meridional do Estado de São Paulo.** [Anophelines of the South of the State of São Paulo.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 37–48, 5 pls., 1 map, 12 refs. São Paulo, 1942. (With a Summary in English.)

An Anopheline survey of the southern part of the State of São Paulo was carried out in view of an outbreak of malaria that occurred there from February to April 1941. A list is given of the Anophelines of Brazil, and the local distribution of the 13 species taken in the survey is recorded and shown on a map. The predominant species was *Anopheles strodei*, Root ; it was present in all the localities visited and was most abundant at altitudes of about 3,000 ft., but, with the exception of a single male, was not found in dwellings. *A. darlingi*, Root, was common in houses in many localities. Oöcysts were found in one female caught in a dwelling where the occupants were infected with *Plasmodium vivax*, and in two of 33 dissected in another locality. No infection of the salivary glands was observed. The larvae occurred in masses of *Eichhornia azurea* at the banks of a river about 100 yards from the houses. *A. oswaldoi* var. *metcalfi*, Galvão & Lane, was taken feeding on man at the doors of houses, and two of 24 females dissected contained oöcysts.

[DA] S[ILVA] RAMOS (A.). **Sobre uma variedade nova de** *Anopheles* (*Nyssorhynchus*) *oswaldoi* **Peryassú, 1922 (Diptera-Culicidae).** [A new Variety of *A. oswaldoi*.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 61–63, 3 pls., 8 refs. São Paulo, 1942. (With a Summary in English.)

Descriptions are given of all stages of *Anopheles oswaldoi* var. *guarujaensis*, n., from Guarujá, in the State of São Paulo, where the adults are common in houses. It is differentiated from some other varieties of *A. oswaldoi*, Peryassú (*oswaldoi*, *metcalfi*, Galvão & Lane, and *noroestensis*, Galvão & Lane) by characters of the eggs.

FONSECA (J. A. B.). **Considerações sobre o** *Anopheles* (*Anopheles*) *eiseni* **Coquillett, 1902, como transmissor da malária humana.** [*A. eiseni* as a Vector of human Malaria.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 75–81, 3 pls., 5 refs. São Paulo, 1942.

The importance of *Anopheles eiseni*, Coq., as a vector of malaria is not definitely known but has usually been regarded as slight. In experiments in São Paulo, females bred from larvae collected locally were allowed to feed on hospital patients infected with *Plasmodium falciparum* and 33 of them were examined after intervals of 4–26 days. Four contained oöcysts and a fifth contained oöcysts and sporozoites. The mosquitos did not feed very readily, so that it is considered that *A. eiseni* can be only an occasional vector. In tests on food preferences, the percentages that engorged on man, sparrow, guinea-pig, horse, fowl and ox were 59, 57, 40·6, 42, 42 and 29·1, respectively. Of a total of 665 females of *A. eiseni*, only 44·2 per cent. fed, as compared with 92 per cent. for *A. albitarsis*, Arrib., and 83·8 per cent. for *A. strodei*, Root, in similar tests.

UNTI (O.) & [DA] S[ILVA] RAMOS (A.). **Anofelismo das alturas no Brasil meridional.** [Anophelines at high Altitudes in southern Brazil.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 91–106, 39 refs. São Paulo, 1942. (With a Summary in English.)

The authors review the literature on the occurrence of Anophelines and malaria at high altitudes throughout the world and give records, based chiefly on collections of larvae, of species taken in the States of São Paulo and Minas Geraes in a mountain range along the coast and a parallel range inland. Anophelines occur in these ranges and in the plain between them, but malaria does not. *Anopheles lanei*, Galvão & Amaral, which is a typical mountain species, was taken in one locality at an altitude of nearly 6,000 ft. The species found from sea-level to about 6,000 ft. were *A. argyritarsis*, R.-D., *A. strodei*, Root, *A. lutzi*, Cruz, *A. parvus*, Chagas, and *A. cruzi*, D. & K. The three species taken at medium heights were *A. darlingi*, Root, *A. albitarsis*, Arrib., and *A. maculipes*, Theo. Adults of *A. darlingi*, which is an important vector of malaria elsewhere, were taken in houses at 3,300 ft. *A. albitarsis*, which is also a vector, was not numerous. *A. oswaldoi*, Peryassú, has previously been recorded only below 2,700 ft., but a single adult of this species was taken at 3,600 ft. No Anophelines were found at altitudes between 6,000 and 8,300 ft. Brief notes are included on the characters of the water in the breeding places observed.

UNTI (O.). **O pH dos solos e dos focos de** *Anopheles* **e a epidemiologia da malária no Brasil.** [The pH of the Soil and of the Foci of *Anopheles* and the Epidemiology of Malaria in Brazil.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 125–158, 1 map, 35 refs. São Paulo, 1942. (With Summaries in English and French.)

The author reviews the literature on the influence of the hydrogen-ion concentration of water on Anopheline breeding and gives a detailed account of his own

work in Brazil, carried out from October 1939 to March 1942, in which he made over 3,000 determinations of the pH of soils and the water of Anopheline breeding places in the State of São Paulo and in adjoining districts in Minas Geraes and Rio de Janeiro. The methods adopted and the geological characteristics of the various districts investigated are described, and detailed records are given of the pH of soil and water and the Anophelines found breeding in each locality. Malaria is prevalent in the coastal area of São Paulo, the plateau region and in the district of São Paulo city, but is absent from the Parahyba Valley and the mountains surrounding it, though Anophelines are present. Its distribution was not found to be related to any constant geological features and there were no constant variations in the pH of Anopheline breeding places associated with it. The latter was not necessarily dependent on the pH of the subsoil. The species found bred normally in natural waters of which the pH ranged from 5·6 to 7·5, though *Anopheles albitarsis*, Arrib., and *A. oswaldoi*, Peryassú, showed some preference for water with a pH of 6–6·6, and *A. darlingi*, Root, preferred neutral or sub-alkaline water. *A. argyritarsis*, R.-D., occurred in breeding places with a pH of 5·6–5·8 as well as in those with a pH of 7.

In experiments in the summer of 1940–41 on the ability of Anophelines to acquire infection with malaria parasites, larvae collected or bred in the Parahyba Valley were either allowed to complete their development there or were taken to a malarious locality on the coast. The resulting females were allowed to feed on carriers of *Plasmodium vivax* or *P. falciparum* and were later dissected. The percentages of mosquitos that became infected in the two localities, respectively, were 1·68 and 31·64 for *A. albitarsis*, 6·45 and 50 for *A. oswaldoi* var. *ayrozai*, Unti, and 0 and 36·36 for *A. strodei*, Root. The explanation of this difference in susceptibility is not known.

Corrêa (R. R.) & [da] S[ilva] Ramos (A.). **Relatório das investigações entomológicas realizadas na represa da Light e ao longo da E. F. Sorocabana, ramal Mayrink-Santos.** [Report on the entomological Investigations made at the Reservoir of the Light and Power Company and along the Mayrink-Santos Branch of the Sorocabana Railway.]—*Arq. Hig. Saude públ.* **7** no. 15 pp. 313–325, 4 pls., 1 fldg. map. São Paulo, 1942.

This paper comprises detailed records of the Anopheline larvae and adults taken at various points on a reservoir and along a railway line near Santos in the spring of 1941. At the reservoir, *Anopheles strodei*, Root, constituted 58·1 per cent. of the total of larvae and adults taken, and *A. albitarsis*, Arrib., 40 per cent. Both appeared indifferent to variations in the temperature and pH of the water. The collections included only 5 larvae and no adults of *A. darlingi*, Root, which is regarded as one of the chief vectors of malaria in the high plateau region of São Paulo. The unfavourable season might account for its temporary scarcity, as it was abundant in the early months of 1940 and 1941. *A. strodei* and *A. albitarsis* were also by far the most numerous Anophelines along the railway line.

Unti (O.). **Anofelinos do Vale do Paraíba. Nota 1.—Sobre a morfologia de alguns ovos.** [Anophelines of the Parahyba Valley. 1st Note. The Morphology of some Eggs.]—*Ann. paulist. Med. Cirurg.* **41** no. 6. São Paulo, 1941 ; also in *Arq. Hig. Saude públ.* **7** no. 15 pp. 355–359, 6 figs., 10 refs. São Paulo, 1942.

The author refers to the work of Galvão on the eggs of *A. strodei*, Root [*cf.* *R.A.E.*, B **27** 227] and gives the results of observations in the Parahyba Valley, São Paulo. He describes eggs with or without floats and the adults derived from them, and also an abnormal type in the group without floats. Characters of the egg and adult of *A. oswaldoi* var. *ayrozai*, Unti, from this region are also described.

Silveira Netto (A.). **Mosquitos do Rio Grande do Sul.**—Tése Fac. Med. Pôrto Alegre, 103 pp., 10 pls., 18 figs., 40 refs. Pôrto Alegre, 1940. [Recd. 1943.]

This thesis consists chiefly of records of mosquitos caught in houses in Pôrto Alegre, a city of 400,000 inhabitants on the Rio Guaiba, a list of those previously recorded from the State of Rio Grande do Sul and keys to the Brazilian subgenera and species of *Mansonia* (*Taeniorhynchus*), *Aëdes*, *Psorophora*, *Haemagogus* and *Orthopodomyia*.

Sinton (J. A.) & Shute (P. G.). **Memorandum on Measures for the Control of Mosquito Nuisances in Great Britain.**—*Med. Mem. Minist. Hlth* no. 238 (revd.), 30 pp., 2 maps, 2 pls., 5 refs. London, H.M.S.O., 1943. Price 6*d*.

This revision of a memorandum already noticed [*R.A.E.*, B **29** 19] differs little from the previous edition, but the list of rare or unimportant mosquitos includes an additional species [*cf.* **29** 17], and a short section on control in tanks of water set up for fire-fighting and in bomb craters has been added. When possible the tanks should be deep and large and in exposed situations. They should be inspected at least once a month, and any floating matter should be removed and the water treated with oil from April to September if larvae are found, or with some other larvicide if the tanks are lined with asphalt or bitumen [*cf.* **30** 160]. Growth of algae can be controlled by adding copper sulphate in solution to give 3½ lb. per million gals. water. Bomb craters in which breeding is found to occur should be filled in or treated in the same way as ponds in the neighbourhood. An additional brief appendix on blood-sucking Diptera other than mosquitos, and maps showing the distribution of indigenous malaria in England and Wales during the eighteenth century and after the war of 1914–18 are included.

Marshall (J. F.). **Mosquitoes in Britain.**—*Biology* **8** no. 1 repr. [2+] 10 pp., 8 figs., 1 ref. London, 1942.

A list is given of the 30 species of mosquitos that occur in Britain and also a table in which they are classified as rural, coastal, arboreal or domestic, and as common or rarely recorded. The difference between the first three groups, members of which overwinter as eggs or larvae only, and the fourth, in which gravid females pass the winter in buildings, is pointed out, and each of the ecological groups is briefly discussed.

Swaminath (C. S.), Shortt (H. E.) & Anderson (L. A. P.). **Transmission of Indian Kala-azar to Man by the Bites of *Phlebotomus argentipes*, Ann. and Brun.**—*Indian J. med. Res.* **30** no. 3 pp. 473–477, 5 refs. Calcutta, 1942.

In five experiments on the transmission of visceral leishmaniasis to man in India, batches of *Phlebotomus argentipes*, Ann. & Brun., were fed on a kala-azar patient and then maintained at 28°C. [82·4°F.] on raisins [*cf.* *R.A.E.*, B **28** 155 ; **29** 85 ; **30** 134] until they were fed on the volunteer whom it was intended to infect. Transmission was effected in all cases. The first volunteer was bitten on ten nights between 20th December 1941 and 3rd May 1942 by 8–116 sandflies of which 0–16 were positive on dissection. He reported sick on 3rd May and sternal puncture was positive for *Leishmania donovani* on 28th. The second was bitten on five nights between 27th December and 6th March by 48–126 sandflies of which 1–16 were positive on dissection. He reported sick on 17th May and spleen puncture was positive on 31st. The third was bitten on six nights between 24th December and 26th March by 21–110 sandflies of which 0–17 were positive on dissection. His spleen was enlarged on 8th June

1942 and spleen puncture was positive on 12th. The intervals between the preliminary infecting meal and the feed on the volunteer ranged from 8 to 13 days. Details are not given of the other two cases.

It is suggested that the success of these experiments may be due to the change in the manner of keeping the sandflies alive after the infecting feed or to the fact that they were carried out when a new epidemic might be expected to begin, whereas the former ones were made when the epidemic was declining [*cf.* **18** 141 ; **19** 175 ; **20** 253].

SARSFIELD (N. F.). **Determination of Fumigants. IX. Composition of heavy Coal-tar Naphtha.**—*J. Soc. chem. Ind.* **61** pp. 1–6, 4 figs. London, 1942. **X. Methods of Analysis of heavy Naphtha and other neutral light Oils.**—*T.c.* pp. 6–13, 6 graphs.

Investigations carried out with the object of improving and standardising the application of heavy coal-tar naphtha as a fumigant against *Cimex lectularius*, L. [*cf. R.A.E.*, B **31** 37] included the correlation of toxicity with chemical composition, and the chemical aspect of this work is dealt with in these papers.

The first is concerned with the separation and preparation of the main components of heavy naphtha, which may be divided into aromatic hydrocarbons (pseudo-cumene, mesitylene and xylene), cycloparaffins (naphthenes), paraffins, and unsaturated substances (olefines) of various types, and the measurement and calculation of their vapour pressures. Toxicity tests with the pure components, alone and in combination, have shown that xylene is much more toxic than the other aromatic hydrocarbons, that the toxicities of paraffins and aromatics are additive, that unsaturated compounds show synergism with paraffins and that phenols are toxic in themselves and also show strong synergism with paraffins and weaker synergism with aromatics [*cf. loc. cit.*] ; and these principles are used to calculate a toxic index, which can be compared with that found in the toxicity tests. This method of calculation can be applied with a reasonable degree of accuracy to the prediction of the toxicity of any given sample of heavy naphtha to *C. lectularius*, and indicates that it is advisable to keep the contents of paraffins and unsaturated compounds approximately equal and the aromatic content as low as possible ; a mixture that would have maximum toxicity consistent with considerations of fire-risk, taint and toxicity to man would contain about 2 per cent. phenols and 15 per cent. xylene.

The second paper contains descriptions of the methods of chemical analysis that were applied to the heavy coal-tar naphtha.

PAPERS NOTICED BY TITLE ONLY.

NÁJERA (L.). **Sobre un caso de oftalmomiasis producida por larvas de *Wohlfahrtia magnifica* Schiner.** [A Case of Myiasis of the Eye (in Man in Spain) due to Larvae of *W. magnifica*.]—*Bol. Soc. esp. Hist. nat.* **40** no. 9–10 pp. 493–495, 1 pl. Madrid, 1943.

KOMP (W. H. W.). **A Technique for staining, dissecting, and mounting the Male Terminalia of Mosquitoes.**—*Publ. Hlth Rep.* **57** no. 36 pp. 1327–1333, 1 pl., 5 refs. Washington, D.C., 1942.

DOUGLAS (J. R.). **Knowledge of the internal Anatomy of *Dermacentor andersoni* necessary to pursue the Study of Rickettsial Infections in the Tick.**—*Proc. 6th Pacif. Sci. Congr. 1939* **4** pp. 487–497, 6 figs., 7 refs. Berkeley, Calif., 1940. [Recd. 1943.]

Macan (T. T.). **A Key to the Anopheline Mosquitoes of the Mediterranean Region and the Lands adjoining the Red Sea and the Persian Gulf.**—*J. R. Army med. Cps* **79** no. 1 pp. 1–11, 1 map, 14 figs. London, 1942.

A malariologist working in the Middle East is near the boundaries of three zoo-geographical regions and consequently has to deal with a complicated Anopheline population. Most of the species are Palaearctic and Mediterranean, and a few are Oriental and Ethiopian. The species likely to be encountered, their distribution and the regions to which they belong are shown in a table, and a key to them is given. This key is a slight modification of one already noticed [*R.A.E.*, B **30** 48], but does not include some corrections to the latter issued subsequently [**30** 176]. Brief descriptions of the features used in distinguishing species and notes on killing and mounting mosquitos are included.

Anderson (W. M. E.). **Anti-sandfly Spraying with Lethane and Pyrethrum.**—*J. R. Army med. Cps* **79** no. 1 pp. 12–24, 2 figs., 2 refs. London, 1942.

Details are given of experiments carried out in Peshawar during the hot season of 1939 on the comparative effectiveness against *Phlebotomus* spp. of atomised sprays of lethane 384 [butyl carbitol thiocyanate (*cf. R.A.E.*, B **28** 131)] in kerosene and five proprietary solutions of pyrethrum extract, three in kerosene and two in water. Methods of application were also studied. The dilution of each material recommended by the manufacturers or in common use, the maximum dilutions lethal to the sandflies on direct contact and the minimum concentrations in cc. undiluted solution per 1,000 cu. ft. that killed sandflies exposed to them in a closed but unsealed room are given. Only lethane was unpleasant to man at the minimum lethal concentration. The effectiveness of the two pyrethrum products in oil that did not contain activators was improved by the addition of 5 per cent. pine oil, and the minimum lethal concentration for the sandflies of one of them was reduced to a greater extent if about 5 per cent. pine oil and 8 per cent. naphthalene were used. The repellent effect of the concentrations of lethane and two of the pyrethrum products in oil built up in a room when they were used at approximately the recommended dilutions was marked 12 hours after spraying but was not apparent after 24 hours. Daily spraying would thus be necessary, but as the sandflies are nocturnal in habit, thorough spraying at dusk would be sufficient. On the basis of the observations described, tentative suggestions are made for applying a satisfactory dosage with two kinds of apparatus.

Knight (S.). **Simple Means for testing the Efficiency of improvised Disinfectors and Disinfestors.**—*J. R. Army med. Cps* **79** no. 1 pp. 45–46. London, 1942.

Improvised methods for testing the temperatures obtained in disinfestors for treating clothing, etc., by heat in the field are described. If dry heat is used, the surface temperature of articles should be raised to about 70°C. [158°F.]. Flour and water mixed to the consistency of thin cream and placed in glass tubes attached to the clothing remains unchanged until a temperature of 60°C. [140°F.] is reached, but at 70°, the mixture will become solid and somewhat translucent. The time taken at temperatures between 60 and 70° for the mixture to change consistency is longer than that required to kill lice [*Pediculus humanus*, L.] and their eggs. In steam disinfectors, the steam issuing from the outlet can itself be used as an indicator [*cf. R.A.E.*, B **30** 98], but a check on the temperature reached throughout the mass of material under treatment is useful. This can be obtained by putting slices of potato about ¼ inch thick among the articles, particularly in spaces where it is suspected that disinfection may not take place.

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The potato will not soften until the temperature reaches 100°C. [212°F.], but when this temperature has been maintained for five minutes, it will be mealy in appearance and the skin will break away.

CLAYTON (T. M.). **Treatment of Scabies by T.E.T.M.S.**—*Brit. med. J.* no. 4292 pp. 443–445, 12 refs. London, 1943.

The author gives details of 93 cases of scabies [*Sarcoptes scabiei*, DeG.] in man in which cure was effected by 1–7 applications of a 20 per cent. emulsion of a preparation containing 25 per cent. tetraethylthiuram monosulphide [*R.A.E.*, B **30** 180], though mild dermatitis resulted in 7 cases, and of 14 cases of severe or severe complicated scabies that were treated 3–5 times with the undiluted preparation. Before treatment, the entire body, with the exception of the head and neck, was washed with soft soap and warm water, and raw or grossly septic areas were dressed with lint moistened with the solution. Cure was effected in 11 cases, and reinfestation probably accounted for the apparent lack of cure in the others. No dermatitis or irritation beyond a preliminary smarting in some severe cases was experienced by 18 patients and 15 volunteers, and the preparation appeared to have beneficial results on some of the secondary concomitants of scabies.

NÁJERA (L.). **La distribución geográfica de las especies de pulgas de interés epidemiológico.** [Geographical Distribution of Species of Fleas of epidemiological Interest.]—*Bol. Soc. esp. Hist. nat.* **40** no. 9–10 pp. 497–502, 6 maps. Madrid, 1943.

The author points out that the only Spanish record shown on the maps given by Buxton in a recent paper on the world distribution of certain fleas [*R.A.E.*, B **30** 55] is that of *Xenopsylla cheopis*, Roths., on the coast of Catalonia. He therefore gives maps based on observations by himself and other workers showing the distribution of *X. cheopis* and *Ceratophyllus* (*Nosopsyllus*) *fasciatus*, Bosc, in Spain and of *X. brasiliensis*, Baker, in the Canary Islands, and reproduces Buxton's data with his own additions on maps according to Mercator's projection. *Pulex irritans*, L., was found at all observation points in Spain.

MIRA (G.). **Sulla presenza di forme larvali di un acaro acquatico parassita, della famiglia degli Hydracnidae, su alcune zanzare del genere *Anopheles* in A.O.I.** [On the Occurrence in Italian East Africa of larval Forms of an aquatic parasitic Mite of the Family HYDRACNIDAE on some Mosquitos of the Genus *Anopheles*.]—*Boll. Idrobiol. A.O.I.* **1** no. 1 pp. 29–33, 3 figs., 3 refs. Addis Ababa, 1940. [Recd. 1943.]

Immature mites of the genus *Atax* were observed parasitising adults of *Anopheles squamosus*, Theo., and *A. pharoensis*, Theo., collected in Abyssinia. Infestation probably occurred while the mosquitos were in the pupal stage, since adults of *A. squamosus* reared in the laboratory were found to be infested on emergence. The mites are briefly described, and the habits of Hydracnids are reviewed from the literature.

PATRIZI (S.). **Nella riserva del Didessa (Galla Sidamo).** [In the Didessa Reserve of the Galla Sidamo Region.]—*Boll. Idrobiol. A.O.I.* **1** no. 1 pp. 57–69, 13 figs., 2 refs. Addis Ababa, 1940. [Recd. 1943.]

In the course of this paper on the fauna of Didessa, the author states that he observed two species of *Glossina* there, one of which was *G. palpalis*, R.-D. They occurred in limited zones, and not, as would have been expected, in forest galleries or beside streams ; they were often abundant on arid heights exposed to the hottest sunshine.

MACAULAY (J. W.). **A Tsetse Fly and Trypanosomiasis Survey in Bechuanaland 1940–1942.**—68 pp., 2 maps (1 fldg.), 1 fldg. table, 60 figs., 38 refs. [? Mafeking] 1942.

As a result of the discovery of four cases of sleeping sickness in 1938 in Ngamiland, Bechuanaland Protectorate [*cf. R.A.E.*, B **28** 24], where trypanosomiasis of stock is frequent and *Glossina* is reoccupying territory that it lost in the rinderpest outbreak towards the end of the last century, it was decided to make a sleeping-sickness survey of the human population and a tsetse-fly and trypanosomiasis survey of the country and stock. This report deals in detail with the latter survey, which was made between 1st July 1940 and 31st December 1941. The history of trypanosomiasis in Ngamiland is very briefly reviewed, an account is given of the procedure followed in the survey, and the physical characters of the country and the vegetation, population and game are described. *G. morsitans*, Westw., was the only species of *Glossina* found, and *Trypanosoma congolense* is the only animal trypanosome present. There are 112,403 head of cattle in Ngamiland, of which 45,272 are in threatened areas. Trypanosomiasis occurs frequently in cattle, only rarely in horses, probably because they are herded with greater care, and very occasionally in goats and donkeys, which are normally kept on or just within the fringe of the fly belt. Sheep are not usually grazed on any threatened area. A scheme for the economic organisation of trypanosomiasis control is suggested. It consists in the compulsory sale of clinically infected stock to a treatment centre for a price greater than the value of the hide, and subsequent treatment and marketing. The importance of mechanical transmission in areas free from *Glossina* was confirmed in 1940.

The account of the survey and discussion upon it include much local detail. Catches of *G. morsitans* were always highest where vegetation was thickest and nearly always higher in thicket with canopy than any other type of vegetation. Breeding took place in the densest forest fringes, on account of the danger of desiccation in the open, where semi-arid conditions prevail. Pupae were not concentrated. Careful study of aerial photographs was found to assist in the location of breeding areas. Destruction of these by cutting small trees and low branches and burning when they were dry was undertaken as routine work in two areas. Subsequent catches showed that clearing made conditions in the immediate neighbourhood quite unsuitable for the fly in one area, but the results in the other were confused ; their possible significance is discussed. The fly population did not appear, in the period of the survey, to be related to rainfall, or to maximum, minimum or mean temperature. The flies were more attracted by a screen bait consisting of a blanket suspended from a pole at shoulder height than by donkey and still more than by man alone. Catches in a " new collapsible " trap of hessian and gauze, previously used in East Africa, were very disappointing, and apparently not influenced by position, but the numbers taken were too small to be significant. A trap similar in shape to the Harris trap [**19** 78] but smaller also failed. No flies were taken in traps during the dry season, when trapping appears to be useless. Harris traps caught very well when there were men in the vicinity [*cf.* **23** 13 ; **28** 75], but not at all otherwise.

In the discussion and conclusions, it is stated that humidity from swamps and the vegetative fringes to swamp channels provide the necessary shelter for the fly, and game is becoming more and more abundant. Advance into new areas is the result of population pressure and requires the availability of shelter and food in the form of game, domestic stock or, failing these, man. For advance to be permanent, there must also be suitable breeding sites, providing soil with a certain amount of humus and shelter from direct sun, wind and flood. Advance is halted by natural barriers consisting of areas that cannot support game or that lack shelter or in which game cannot be readily located,

or by artificial barriers consisting of areas that have been invaded by fire or inhabited areas in which shelter and game are reduced. Local examples of the operation of these limiting factors are given, and " danger areas " into which the advance of the fly is considered possible unless the balance of factors is changed are discussed. These include Maun, the capital. The situation in the Chobe Fly Belt some 20 miles to the north, where there are 9,700 head of cattle, is briefly discussed. In the course of two visits, *G. morsitans* was the only species found. It is possible, but not proved, that the two belts are confluent.

Great persuasion will be required to bring the Ngamiland natives to support control work actively, and the administrative problems are discussed. Recommended measures include the selection of grazing grounds to be maintained, the settling of families along the edge of all danger areas, the erection of fences of thorn bush against game, thicket control, the provision of traps, the adoption of the scheme for compulsory treatment of infected stock, the control of game, and certain clearing work, details of which are given. No area should be allowed to be a game reserve. References to *Glossina* in Ngamiland in works published between 1850 and 1917 are reviewed.

Since the conclusion of the sleeping-sickness survey, there has been a serious recrudescence in one area. A few notes on the occurrence of the disease and its dispersal are included, and the recommendations made by I. W. Mackichan in the report on the 1939–40 sleeping-sickness survey are given. They are that a sleeping-sickness patrol should be established, the inhabitants of certain villages transferred to tsetse-free areas, and return to the old villages or the erection of new ones in the fly-belt prohibited, and bush clearing in a specified area carried out.

Finally, it is suggested that Ngamiland could be surrounded by a cattle-free desert zone, all the cattle in Ngamiland and Chobe inoculated against rinderpest, and the disease then introduced among the large ungulates in the swamp area to reduce the food supply of the tsetse.

SMART (J.). *Simulium* **feeding on Ivy Flowers.**—*Entomologist* **76** no. 956 pp. 20–21. London, 1943.

On four consecutive days in September 1942, large numbers of *Simulium salopiense*, Edw., were observed in Herefordshire, apparently feeding on the flowers of several ivy plants at some distance from each other. Over 500 were caught by a few sweeps of the net over one plant without an appreciable difference being made to the number hovering round the flowers. The proportion of males to females was about 6 : 1. Of 12 females dissected, nine had completely undeveloped ovaries and clear fluid in the stomach similar to that in the males, two had partly developed ovaries and clear fluid in the stomach, and one had undeveloped ovaries and dark fluid, apparently partly digested blood, in the stomach. The breeding place was a river $\frac{1}{2}$–1 mile distant, and there were plenty of cattle and other animals between it and the ivy plants. The flies made no attempt to leave the flowers to feed on the author, and the cattle in the neighbourhood were not being exceptionally pestered by Simuliids at the time.

EAGLESON (C.). **Sesame in Insecticides.**—*Soap* **18** no. 12 pp. 125, 127, 2 graphs, 5 refs. New York, N.Y., 1942.

Sesame oil alone, among a large number of vegetable and other oils tested, increased the effectiveness of fly-sprays of pyrethrum extract in oil. In tests on house-flies [*Musca domestica*, L.] by the hypnotic-dose technique [*R.A.E.*, B **29** 185], 92 per cent. of the flies recovered within 3 hours from the effects of a spray of about one-third the pyrethrin concentration required to give satisfactory control and containing no sesame oil, whereas only 12 per cent. recovered within 6 hours from the effects of a similar spray containing 5 per cent. sesame oil. Sprays containing 1 or 3 per cent. sesame oil were much inferior to those

containing 5 per cent., but sprays containing 10 per cent. showed no great increase in effectiveness. The addition of sesame oil increases the initial effect per unit amount of toxic substance and also prolongs the effect, so that most of the insects are unable to recover. The strongest flies recovered from the spray containing no sesame oil after 15–30 minutes, but the addition of 5 per cent. delayed the onset of recovery until 3–4 hours after spraying. Sesame oil was not toxic to house-flies when used pure or diluted with kerosene. Field tests of livestock sprays containing it were favourable. When applied directly to the coats of cattle, it did not harm them.

BUSVINE (J. R.). **The Toxicity of some common Fumigants to Body Lice.**—*Bull. ent. Res.* **34** pt. 1 pp. 19–26, 1 fig., 3 refs. London, 1943.

An account is given of laboratory and practical experiments on the fumigation of houses and garments infested with body lice, *Pediculus* [*humanus*, L.]. The bed-bug, *Cimex* [*lectularius*, L.], was included in many experiments as a standard of comparison. In laboratory experiments, the eggs of both insects were more resistant to sulphur dioxide and trichlorethylene and less resistant to hydrocyanic acid gas than the adults. The last-instar nymphs of the louse were slightly, but significantly, more resistant than the adults. The concentrations of the three fumigants calculated to give 50 and 99 per cent. kill of various stages of both insects with stated exposures, and the periods of exposure needed to give 50 and 99 per cent. mortality of lice and their eggs with saturated vapours of drained creosote salts, whizzed naphthalene (drained creosote salts partly purified by centrifuging), pure flaked naphthalene, paradichlorobenzene, heavy naphtha and trichlorethylene are shown in tables. Among the latter, the less volatile compounds required longer exposures, but their effect was achieved by very much lower concentrations. The crude samples of naphthalene were more toxic than the refined one.

In practical tests of the effectiveness of sulphur dioxide, hydrocyanic acid gas and chloropicrin for house fumigation, made at various times between January and August, small muslin bags containing adult lice, eggs or bugs were placed about the rooms before fumigation, sometimes under blankets or among furniture, and the premises were sealed with strips of gummed paper. A table shows the sites of the trials (flat, top-floor room, ship or fumigation van), the dosage, exposure, air temperature and wind, the concentrations found after 1, 2, 4, 6, 12 and 24 hours, and the kills of lice, louse eggs and bugs exposed or under one layer of blanket, under 2–3 layers of blanket and under 3–6 layers of blanket. The maximum concentration of sulphur dioxide was attained about two hours after the sulphur candles had been lighted. The rate of the fall in concentration depended on the strength of the wind. Sulphur dioxide at 32 oz. per 1,000 cu. ft. was effective, except against well protected lice when the wind was strong. Eggs survived in more exposed positions than adults. Only lice in protected positions survived 6 oz. hydrocyanic acid per 1,000 cu. ft., and 16 oz. gave complete kill of lice and eggs. Chloropicrin at 21 oz. per 1,000 cu. ft., the only dosage tested, killed both lice and eggs, but was expensive and difficult to remove by airing. It did not kill bugs. The exposure, temperature, dose and percentage kill of lice and eggs in tests of the disinfestation of artificially and naturally infested garments in bins with the compounds tested as saturated vapours are shown in a table. The substances showed the same order of effectiveness as in the laboratory experiments. Solids acted extremely slowly, being unreliable even with an exposure of 20 hours at 20°C. [68°F.], and were ineffective against the eggs. Complete kills of adult lice were obtained in $5\frac{1}{2}$ hours by heavy naphtha and trichlorethylene at dosages equivalent to 1 or 2 gals. per 1,000 cu. ft. All eggs were killed only by trichlorethylene at the higher dosage.

MacLeod (J.). **A Survey of Sheep Blowflies.**—*Bull. ent. Res.* **34** pt. 1 pp. 65–88, 4 figs., 12 refs. London, 1943.

The literature on the species of blowflies that infest sheep is briefly reviewed, and an account is given of a survey made in the British Isles from 1938 to 1941, in which larvae from over 1,000 cases of strike were reared and the adults identified. A few cases were also examined in 1934–36. The British Isles are divided into 16 regions, the limits of which are shown on a map, and each is briefly described and the results from it are discussed. The following is based on the author's summary. *Lucilia sericata*, Mg., is the principal species concerned in all regions. *L. caesar*, L., is important in Scotland, northern England and North Wales, and *Phormia terraenovae*, R.-D., is next in importance to it in the same areas [*cf. R.A.E.*, B **25** 134; **26** 83; **30** 139] with the exception of North Wales, where it apparently does not occur on sheep. *L. caesar* was not recovered from the low coastal region of North Wales. It occurred occasionally in the south. Both these species are apparently capable of acting as primary flies. *Calliphora erythrocephala*, Mg., and, more rarely, *C. vomitoria*, L., occur on sheep fairly generally over the country, but only in very small numbers. Larvae of *Muscina* spp. were recovered from only three cases, one each in Scotland, England and Ireland, and in very small numbers. *L. caesar* and the closely related *L. illustris*, Mg., were not differentiated in many samples, but the latter would seem to be more common in lowland areas than in the north and west. Species other than *L. sericata* occurred in 47 per cent. of the strikes north-west of a line from Inverness to Glasgow, in over 20 per cent. of those between this and a line from East Lothian to Morecambe Bay, and in about 10 per cent. of those in the Cheviots, Pennines and hills of Wales. Farther south and east they were rare. Within these belts there appeared to be certain regions favourable to strike by these species. *P. terraenovae* appears to infest sheep only in favourable regions, while *L. caesar* does so to a relatively great extent in favourable regions and in some degree throughout the country, and *Calliphora* spp. to a small extent in favourable regions and sporadically elsewhere. *P. terraenovae* and *L. caesar* are more plentiful in the first half of the fly season than after July. There was some indication that *C. vomitoria* was restricted to the extremes of the season (May–June and September).

Caudri (L. W. D.). **The Braconid** *Alysia manducator* **Panzer in its Relation to the Blow-fly** *Calliphora erythrocephala* **Meigen.**—Proefschr. Univ. Leiden, 91 pp., 2 pls., 13 figs. Haarlem, 1941. (Abstr. no. 15517 in *Biol. Abstr.* **16** no. 6. Philadelphia, Pa., 1942.)

The results are given of a detailed study carried out in the laboratory in Holland of the development of the Braconid, *Alysia manducator*, Panz., in *Calliphora erythrocephala*, Mg., with notes on the technique of breeding both insects. A successful technique for fixing the parasite within its host for the cutting of serial sections is described. Much of the development of *A. manducator* takes place in the larva of the host, and parasitism does not appear to accelerate pupation. The parasite egg hatches 3 days after deposition and the larva is usually in the second instar when the host pupates. The development of the parasite is not qualitatively affected by the stages of its host. The first and second larval instars each last two days and the third one day, while the fourth varies in duration. Development from oviposition to adult emergence from the host puparium required 33–90 days, usually 40–50. Eggs were readily laid in larvae already parasitised, and the distribution of eggs over the available number of hosts is probably quite arbitrary. When several eggs are laid in a single host, only one parasite at most will become full grown.

LINDQUIST (A. W.). **Ants as Predators of *Cochliomyia americana* C. & P.**—*J. econ. Ent.* **35** no. 6 pp. 850–852, 1 ref. Menasha, Wis., 1942.

In observations in south-central Texas between May and October in 1936 and 1937, only 4·1 per cent. of the 26,750 third-instar larvae of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) on exposed carcasses of sheep and other animals that had died as a result of heavy infestations gave rise to adults, but there was 93·1 per cent. emergence from carcasses protected from ants. Ants attacked the larvae on every exposed carcass or moribund animal studied, thousands often collecting in a few minutes, and the low emergence of flies in the field is attributed almost entirely to them. A list is given of the species found, with notes on their relative effectiveness. In 196 varied field tests made at different times of year in 1937 and 1938, in which larvae were dropped in small batches to simulate those leaving wounds, total emergence was 19·8 per cent., whereas 70–100 per cent. emergence occurred in jars of dry sand protected from ants. Holes in puparia dug out of the soil indicated that ants destroy these also. Carrion was shown to attract the ants, and this probably accounts for the greater survival among larvae dropping from wounds than among those on carcasses. Emergence was low in both cases, and it is concluded that ants are an important factor in the control of *C. hominivorax*, having full effect from March to December and probably continuing to operate throughout the year.

KNIPLING (E. F.). **A preliminary Report on a Treatment for Fleece-worm Infestations in Sheep.**—*J. econ. Ent.* **35** no. 6 pp. 896–898, 8 refs. Menasha, Wis., 1942.

Preliminary results are given of tests carried out during April and May in 1939 and 1940 in Texas on the effectiveness of combinations of benzene, as a larvicide, with certain synthetic organic compounds [*cf. R.A.E.*, B **30** 44], for protecting wounds from reinfestation, against *Phormia regina*, Mg., *Cochliomyia macellaria*, F., and *Lucilia sericata*, Mg. (fleece worms) causing cutaneous myiasis in sheep. It was desired to control *C. hominivorax*, Coq. (*americana*, Cush. & Patt.) and the fleece worms in one operation, and the materials were chosen accordingly [*cf.* **14** 43 ; **30** 165, 195]. The wool from the area round the wound was shorn before treatment, and the treated sheep were kept under observation, in a pasture when fleece-worm flies were active, until the wounds healed. Combinations of 15 per cent. diphenylamine or diphenylene oxide (with or without 10 per cent. of a wetting agent) or *p*-nitrophenetole with benzene were tested on a total of 155 artificially infested sheep, and only one reinfestation occurred ; this was among 33 animals that received diphenylamine. There were 34 reinfestations among 44 sheep treated with benzene alone. The combinations of benzene with diphenylamine or diphenylene oxide gave complete protection to 14 naturally infested sheep. The treatments repelled ovipositing females and killed eggs and any larvae that managed to hatch. These results indicated that any of the compounds tried would be satisfactory in combination with benzene, but diphenylamine would be the most practical as it is used in the treatment of infestation by *C. hominivorax* [**28** 237 ; **29** 137]. It is questioned whether the increased cost of a wetting agent is justified. In an experiment on the treatment with benzene and diphenylamine or diphenylene oxide of 21 animals that had not been previously shorn, 3–4 times as much of the solution was required, and 3 reinfestations occurred on the third, fourth and fifth days among the 15 animals treated with benzene and diphenylamine. Six sheep treated with benzene alone were all reinfested the next day.

PARISH (H. E.). **Factors predisposing Animals to Screwworm Infestation in Texas.**—*J. econ. Ent.* **35** no. 6 pp. 899–903, 2 refs. Menasha, Wis., 1942.

During an examination of more than 6,000 wounds infested with screwworms [*Cochliomyia hominivorax*, Coq.] in sheep, lambs, goats, kids, cattle and

calves and a few horses and pigs in the Edwards Plateau area of east-central Texas between 1936 and 1940, 43 factors predisposing the animals to infestation were recorded. Of these, 7 were classified as man-made, 8 others as avoidable, 6 as partly avoidable, 4 as requiring veterinary aid and 18 as not controllable to any extent. A table shows the number of infestations attributable to each cause in each class of animal; and the more important types are discussed and recommendations made for eliminating some of them. Among the most important types of wounds were shear cuts, which were responsible for 48·1 per cent. of the infestations in goats, 73·8 per cent. in kids and almost 5 per cent. in sheep, those from birth, responsible for 63·7 per cent. of the infestations in calves and 8·4 per cent. in cattle, and those caused by needlegrass, which were responsible for 35·9 per cent. of the infestations in lambs and 27·8 per cent. in sheep. Over 21·3 per cent. of the infestations in goats resulted from boils, which were, however, unimportant in other animals, and over 32 per cent. of those in cattle from attack by horn flies [*Lyperosia irritans*, L.]. Fighting wounds were a serious predisposing factor to infestation in rams. Ear ticks [*Ornithodoros megnini*, Dugès] were responsible for over 7 per cent. of the infestations in lambs and over 3 per cent. in sheep and cattle [*cf. R.A.E.*, B **30** 65].

OWEN (W. B.). **The Biology of *Theobaldia inornata* Williston, in captive Colony.**—*J. econ. Ent.* **35** no. 6 pp. 903–907, 7 refs. Menasha, Wis., 1942.

Theobaldia inornata, Will., proved to be well suited to rearing in captivity when the colonies were kept at 60–70°F., and a humid atmosphere was maintained for the adults, which were usually kept in glass jars. Various proprietary products were tried as food for the larvae, but though all supported development, the best results were obtained by reproducing the natural habitat. The minimum duration of the larval stage with this medium was 15 days, and the life-cycle took about 30 days. The adults paired readily in small cages or even in pint jars. Males mated repeatedly, principally after the first day, but females paired within a few minutes of emergence and usually only once. They took a blood-meal when 2–3 days old if starved or 5–6 days old if they had been supplied with sugar, and they oviposited 5 days later. Blood or sugar should be given immediately after oviposition. The relation of blood-meals to the maturing of eggs is discussed. The average number of egg-rafts deposited by 14 females isolated after mating was 5 and of eggs 700·79, of which about 98 per cent. were fertile and 88 per cent. hatched. The average number of blood-meals taken was 5·57 and the average length of life 95·79 days.

HUTZEL (J. M.). **The activating Effect of Pyrethrum upon the German Cockroach.**—*J. econ. Ent.* **35** no. 6 pp. 929–933, 4 figs., 2 refs. Menasha, Wis., 1942. **Action of Pyrethrum upon the German Cockroach.**—*T. c.* pp. 933–937, 1 fig., 9 refs.

Four methods of recording the initial effects of pyrethrum in stimulating muscular reaction in the legs of *Blattella germanica*, L., are described in the first paper. Each demonstrated different features of its action. The results indicated that pyrethrum is unique in its activating effect; insecticides containing *n*-butyl carbitol thiocyanate, rotenone or nicotine did not cause similar violent reactions. The reactions to pyrethrum powder or pyrethrin solutions usually resembled one another except that the effect of the powder was delayed. It is pointed out that the activating effect of pyrethrum is of practical value, as sublethal doses cause the cockroaches to leave their hiding places and expose themselves to lethal doses. Treated cockroaches dragged their abdomens along the ground, and this resulted in more of the poison being picked up if it was applied in the form of a dust.

The second paper deals with a study of the factors influencing the reactions recorded in the first one.

JAMES (M. T.). **A Two-season Light Trap Study of Mosquitoes in Colorado.**—*J. econ. Ent.* **35** no. 6 p. 945. Menasha, Wis., 1942.

The numbers of four species of mosquitos caught in a light-trap at Fort Collins, Colorado, in each week from 25th May to 27th September in 1941 and 1942 are given in a table. The species, in descending order of abundance, were *Aëdes vexans*, Mg., *A. dorsalis*, Mg., *A. nigromaculis*, Ludl., and *Culex tarsalis*, Coq. Five other species were taken in insignificant numbers.

ALVARADO (C. A.). **Paludismo.** [Malaria.]—*Bol. sanit. Dep. nac. Hig. Argent.* **6** no. 4–6 pp. 155–166. Buenos Aires, 1942.

This report on malaria in Argentina in 1941 contains a section (pp. 155–162) on epidemiology, in which it is stated that the disease is endemic in the north-west and epidemic along the coast, where outbreaks occur at intervals of about ten years. In 1941, there was a notable decrease in the north-west, but many cases were reported in the coastal zone, which adjoins and is subsidiary to the endemic zone formed by Paraguay and the State of Matto Grosso, Brazil. In the north-west malaria occurs in the first months of the year, but in the coastal zone it reaches its greatest intensity in June and July, though Anophelines are produced in maximum numbers from December to March. This lag in transmission may be due to the longer life of Anophelines in autumn and winter, or the vector, probably *Anopheles albitarsis*, Arrib., which is a zoophilous field species in summer, may seek shelter in dwellings in autumn and winter and thus come into contact with man. Adults and breeding places of *A. pseudopunctipennis*, Theo., were much less abundant in 1941 in the areas in which control measures are carried out [*cf. R.A.E.*, B **27** 13]. *A. strodei*, Root, first noted in Tucumán in 1940, was found to be widespread there in 1941, but this apparent increase is ascribed to more effective identification. The only examples so far taken in dwellings have been two males, so that this species is probably not of importance in the transmission of malaria.

[BEKLEMISHEV (V. N.).]. **Беклемишев (В. Н.). On the Factors determining the Importance of the different *Anopheles* Species as Malaria Vectors.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 5–8. Moscow, 1941. [Recd. 1943.]

In this paper, which is introductory to those that follow, it is pointed out that the species of *Anopheles* that occur in the Russian Union are not all of equal importance in the transmission of malaria, and that a given species may be a vector in one district and not in another. A brief survey is therefore made of factors that affect the epidemiological importance of a particular species, and examples of each are given. The most important are the degree of its susceptibility to infection with the parasites of human malaria ; the period for which it can preserve the sporozoites in its salivary glands ; its abundance and feeding preferences ; the degree to which it disperses in search of food ; and the percentage of individuals in a given locality that actually feed on man, which depends on meteorological conditions, the relative abundance of the various hosts, and the type of buildings in which they occur. Other factors include the presence or absence of mosquitos at the time of the year that is most favourable for the transmission of malaria, the type and degree of permanency of the breeding places, the percentage of females that live long enough for the sporozoites to mature, temperature preferences and hibernation habits.

[SHIPITZINA (N. K.).] **Шипицина (Н. К.). The entomological Basis of the Epidemiology of Malaria in Adler District (Caucasus).** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 9–24, 5 graphs, 4 refs. Moscow, 1941. [Recd. 1943.]

A detailed account is given of observations on *Anopheles maculipennis*, Mg., and *A. claviger*, Mg. (*bifurcatus*, auct.) carried out in 1938 in the district of

Adler, on the Black Sea coast of the Caucasus, where malaria is endemic. The area surveyed comprised a Russian settlement and two Armenian villages, situated at altitudes varying from 65 to 1,200 ft. It was only a few square miles in extent but showed great variation in contours, soil and climate, and this was reflected in differences in the ecology and breeding places of the mosquitos and the transmission of malaria.

A. maculipennis was represented by var. *typicus*, which predominated, and vars. *atroparvus*, van Thiel, and *subalpinus*, Hackett & Lewis, which occurred in small numbers. Its chief breeding places in spring, early summer and autumn were pools and stagnant water in small pits, ruts and hoof-prints, and most of them were well heated by the sun and covered with vegetation. In the summer, the larvae were abundant in sunlit places with suitable vegetation in streams and rivers, which became shallow towards July, and in shallow patches of water that occurred over a large area near a dam and were overgrown with vegetation. The distribution of the adults in day-time shelters was found to depend on relief and air currents. They were most numerous in shelters on the slopes of river valleys, especially near swampy places and spring-fed pools, and scarce in shelters on the top of the ridge of hills or in ravines at a distance from breeding places. In the evening, cold air currents from the hills would carry the smell of cattle and human dwellings, and the mosquitos would fly up the valleys in search of food, being guided by the smell.

The chief day-time shelters of *A. maculipennis* in the Russian settlement were in the inhabited houses, which were low, dark and damp, with small windows, and in the lofts ; some occurred in cow-sheds that were not exposed to the sun and wind. In the Armenian villages the houses had lofty and airy living-rooms built over the animal quarters, which were usually enclosed on all sides and so better protected from the sun and damper than those in the Russian settlement ; consequently, the mosquitos mostly congregated in the animal quarters during the day. A large percentage of the mosquitoes taken in houses contained the blood of animals, and some of those taken in the cow-sheds contained human blood, which indicated that they had fed outdoors. A few entered the animal quarters immediately after sunset, but none did so at night ; most entered them between dawn and 8 a.m., and over 50 per cent. of these had fed, but few remained until blood digestion was complete. Most mosquitos left the shelters at dusk.

The composition of the population of *A. maculipennis* in the day-time shelters is discussed in detail. The number of males and hungry females varied inversely with the distance from the breeding places. In some houses near the latter, hungry females constituted up to 22–40 per cent. of the mosquitos present in July, which afforded further evidence that the houses were used as temporary shelters rather than as places for feeding. In the Russian village, the deviating rôle of the cattle sheds was small during the hot months, as few animals were left in them at night, the houses were easily accessible and the microclimate in them was more suitable. In June and October, however, 8–13 times as many mosquitos occurred in the cow-sheds as in the houses. In the Armenian villages, on the contrary, the deviating rôle of the animal quarters was great, as the living rooms were less suitable and less accessible.

Cases of divergence from the normal gonotrophic cycle were frequent, the development of the ovaries being retarded or accelerated as compared with blood digestion ; the percentage of abnormal individuals was least in June and greatest in October. Females with a developed fat-body appeared at the beginning of August, and those with mature ovaries occurred up to 25th October. All the females were in a state of gonotrophic dissociation at the beginning of November, when they imbibed blood but the ovaries did not develop, and this renders infection possible during autumn and winter in the houses.

The larvae of *Anopheles claviger* occurred in standing water fed by springs, with a temperature of 18–23°C. [64·4–73·4°F.]. Some were found in the middle

of summer, when many springs had dried up, in a large pool in the basement of a house together with larvae of *A. maculipennis*, *A. plumbeus*, Steph., and *Culex theileri*, Theo. The adults were most numerous in the last third of June and the last third of September, during which periods they were commoner in the open than those of *A. maculipennis*, but much less common than the latter in cow-sheds. They were more numerous by day in animal quarters than in other indoor resting places, but it appeared that they entered them for shelter only. They fed in the open, where they attacked man as well as animals. They did not disperse far from their breeding places. There were few cases of divergence from the normal gonotrophic cycle, which indicated that the ovaries developed chiefly as a result of feeding on blood [see next abstract].

[Markovich (N. Ya.).] **Маркович (Н. Я.). New Data on the Biology of** *A. bifurcatus* **(Observations in North Caucasus).** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 24–34, 4 figs. Moscow, 1941. [Recd. 1943.]

An account is given of laboratory investigations in the northern Caucasus showing that females of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) that have not taken blood are able to oviposit autogenously [*cf. R.A.E.*, B **27** 183], and of observations on the correlation between digestion and ovarian development of females caught in nature, in some of which the gonotrophic cycle was completed normally, while others developed eggs without having taken blood.

During June and July, the chief breeding places were the shaded parts of small pools near forest streams. The water was clear and free from vegetation, its temperature was 8–16°C. [46·4–60·8°F.], and the bottom frequently consisted of pebbles. The larvae were also found in pools in meadows, in which the temperature reached 22–23°C. [71·6–73·4°F.]. From the end of August, however, larvae and pupae occurred in larger swampy pools formed in forests by seepage and summer floods. These pools had abundant vegetation and a slimy bed covered with a layer of detritus smelling strongly of hydrogen sulphide, but the larvae were most numerous in parts devoid of vegetation and covered with fallen leaves. They were also found in water in pits made by wild boars, which were numerous in this area.

The adults were present throughout the summer and were still numerous in October, owing to the abundance of the forest breeding places. There was a decrease, however, in July. They were much more common outside than within the villages, but some were taken by day in cattle sheds and a very few in houses. Most of those that had fed in the village flew away before blood digestion was completed. They attacked man at any time of the day or night, but were most active just before and after sunset. During the summer, 162 females that had not taken blood were examined ; 24·9 per cent. showed evidence that autogenous development of the ovaries had begun, and most of them were fertilised, which indicates that reproduction can take place without a blood-meal. Precipitin tests made on over 400 mosquitos taken in day-time shelters showed that the majority had fed on domestic animals and only 1·7 per cent. contained human blood.

It is concluded from these observations that *A. claviger* does not disperse far from its breeding places and feeds on hosts that it encounters accidentally. The autogenous ovarian development ensures the propagation of the species without the necessity of dispersal in search of a blood-meal.

[Shlenova (M. F.).] **Шленова (М. Ф.). The Biology of** *A. plumbeus* **and its epidemiological Significance in Abkhazia.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 34–39, 1 graph. Moscow, 1941. [Recd. 1943.]

Observations on *Anopheles plumbeus*, Steph., in May–October 1938 in a health resort in the district of Sukhum showed that its bionomics were similar to those in Sochi [*cf. R.A.E.*, B **27** 73]. The adults resulting from the overwintered

larvae emerged from 4th May till mid-June, and young larvae of the first generation were first found on 16th May. The mean temperature of the air in May was 16·1°C. [60·98°F.] and that of the water in the tree holes 14·6°C. [58·28°F.], rising in June to 18·5°C. [65·3°F.]. Pupation took place about 20th June and the adults began to emerge on 26th June. No larvae were found tree holes between 20th July and 20th August, as the water in them had dried up, but they occurred in dark brown water with a temperature of 19–22°C. [66·2–71·6°F.] in shaded depressions in a dry river bed, the bottoms of which were covered with algae and fallen leaves. They congregated under projecting stones, where they were sheltered from the sun, whereas larvae of *Anopheles maculipennis*, Mg., and *A. claviger*, Mg. (*bifurcatus*, auct.) occurred in water exposed to light. Larvae of *A. plumbeus* in tree holes appeared again in September, after rains.

Development from egg to adult in tree-hole water in jars sunk to soil level in dense shade required 25 and 24 days at mean temperatures of 20·2°C. [68·36°F.] in June and 26·1°C. [78·98°F.] in August, respectively. The percentage mortality was 52 in June and 60 in August.

The day-time shelters were of the same type as in Sochi [*loc. cit.*], while in the forest the adults rested near frequented paths and inhabited places and were absent from areas to which man or domestic animals seldom penetrated. In summer, the gonotrophic cycle was normal, but cases of dissociation occurred in May and October. Thus, 15 females taken in May in tree holes in a forest had ovaries in stage III [*cf.* **29** 93], but had not taken blood, which indicates that *A. plumbeus* may possibly be capable of autogenous ovarian development like *A. claviger* [*cf.* preceding abstract]. Females were active at relative humidities of over 80 per cent., and fed readily in cold damp weather, but remained in their resting places when it was hot and dry. Of those that gave positive results in precipitin tests, 61·4, 3·5 and 35·1 per cent. contained the blood of cattle, pigs and man, respectively. It is considered, therefore, that *A. plumbeus* might be a dangerous vector of malaria if it were more abundant. Filling in the tree holes should be made obligatory near health resorts.

[Avdeeva (T. Ya.) & Nikiforova (A. V.).] **Авдеева (Т. Я.) и Никифорова (А. В.). Winter Biology of the Anophelines of Sochi (Caucasus).** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 39–44. Moscow, 1941. [Recd. 1943.]

Observations on Anophelines near Sochi on the Black Sea coast [*R.A.E.*, B **27** 73] were continued from 25th October 1937 to 15th May 1938. The hibernation quarters of *Anopheles maculipennis*, Mg., var. *typicus* comprised warm shelters occupied by animals, such as cow-sheds and stables, and cold uninhabited shelters, such as cellars and store-rooms. As, however, the numbers of mosquitos found in winter were very small in comparison with the abundance of the overwintered generation in spring, it is probable that the majority overwintered in natural shelters in the open. The females migrated from cow-sheds to colder hibernation quarters in November, when the fat-body was fully developed, and returned to the cow-sheds from January onwards, as it began to be exhausted. In 1938, the first female with mature eggs was caught on 25th April at a temperature of 20·3°C. [68·54°F.], first-instar larvae were found on 8th May in shallow pools of rain water with a temperature of 20°C. [68°F.], and the first adult male was taken on 15th May.

No oöcysts of malaria parasites were found in the 146 females dissected, but two contained sporozoites. One of these, which was taken in a dwelling on 28th October, contained fresh human blood and, from the size of the ampullae, had evidently oviposited and fed repeatedly. In the other, which was taken on 29th January in a basement, the sporozoites had degenerated, and the fat-body was almost exhausted. This mosquito had apparently not yet oviposited, but

had fed on blood while in a state of gonotrophic dissociation. It appears from these findings that malaria could be transmitted to man in late autumn, as the mean temperature in October–November (18°C. [64·4°F.]) permits the maturation of the sporozoites. From January to April the temperature is too low for sporozoites to mature, and those that have begun to develop earlier degenerate. The mosquitos could not again become infected until April–May and could not transmit the disease to man before the last 10 days in May. Of the 51 winter females that gave positive results in precipitin tests, only 3 contained the blood of man.

No adults of *A. plumbeus*, Steph., were taken in 1937 after 20th November, when the temperature was 9·2°C. [48·56°F.]. The overwintering eggs hatched in January, February and March, and the first pupae were found on 29th April in water with a temperature of 11°C. [51·8°F.]. The first adults were taken on 4th May. In winter, the larvae in the tree holes always kept in the shade; when the water became covered with ice they embedded themselves in the mud at the bottom, where they survived complete freezing of the water for 10 days [*cf.* **24** 71, 139].

Larvae of *A. claviger*, Mg. (*bifurcatus*, auct.) were found in many types of breeding places that had been too warm for them in summer, as they apparently required a temperature lower than 20°C., but they did not occur in swiftly flowing streams. Pupae were not found till the end of April, but the first adults of 1938 were taken on 29th April in animal quarters in which the temperature was 14°C. [57·2°F.] and the relative humidity 81 per cent. The last adults of 1937, all of which were unfed and inactive, were taken at the beginning of December in a basement in which cows were kept; the temperature was 10·4°C. [50·72°F.] and the relative humidity 78 per cent.

[Mitrofanova (Yu. G.).] **Митрофанова (Ю. Г.). The Ecology of Adults of *Anopheles pulcherrimus* and *A. hyrcanus* in the Valley of Murgab River.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 45–51, 5 graphs, 7 refs. Moscow, 1941. [Recd. 1943.]

An account is given of observations carried out in 1935 near the town of Merv in the valley of the river Murghab in Turkmenistan to determine the feeding habits and longevity of the adults of *Anopheles hyrcanus*, Pall., and *A. pulcherrimus*, Theo., both of which were abundant there [*cf. R.A.E.*, B **21** 97]. The former is a field species, whereas *A. pulcherrimus* rests during the day in buildings in the villages and among the surrounding vegetation, thus coming into frequent contact with man, and is the chief vector of malaria in the district. In the two villages studied, the domestic animals consist mainly of cows, which are kept in the open or in sheds that are easily accessible to mosquitos. The inhabitants sleep in the open, and do not use mosquito nets. Precipitin tests showed that of the females of *A. pulcherrimus* taken in dwellings and cow-sheds, 48·6 and 10·5 per cent., respectively, contained human blood, which indicated that houses were entered not only for rest but also in search of food. The other females contained the blood of animals, chiefly cows; 5–7 per cent. had fed on fowls. None of the females taken on vegetation near one of the villages contained human blood and 71·4 per cent. had fed on cows, which were driven past in the early morning and again after sunset, when the mosquitos were most active.

Most of the adults of *A. hyrcanus*, which were collected only among vegetation near the villages, had fed on cattle and only a few on other animals, birds or man, though the percentage containing human blood increased with the proximity of dwellings.

Examination of the oviducts showed that the percentage of young females was higher among *A. hyrcanus* than among *A. pulcherrimus*, possibly because the latter was collected chiefly in houses, where very few young females occurred. Young unfed females of both species were commonest on the banks

of the river close to the breeding places and among the vegetation near the villages. The age of the mosquitos increased as autumn approached, and almost all those present in the field at the end of August had completed several gonotrophic cycles ; these are probably the mosquitos responsible for the autumn outbreaks of malaria that are characteristic of the Murghab valley and occur throughout Central Asia.

[BUYANOVA (O. F.) & ZVYAGINTZEV (S. N.).] **Буянова (О. Ф.) и Звягинцев (С. Н.). On the Transmission of Malaria by** *A. maculipennis* **and** *A. hyrcanus* **in the Far East.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 52–61, 4 graphs. Moscow, 1941. [Recd. 1943.]

The Anophelines found in the district of Blagoveshchensk on the Amur in July–September 1937 were *Anopheles hyrcanus*, Pall., and *A. maculipennis* var. *messeae*, Flni., the former being the more abundant. Climatic conditions were such that *A. maculipennis* could produce only two generations a year, but *A. hyrcanus* possibly had a partial third. The adults of *A. maculipennis* were most numerous at the end of July and beginning of August, and the last engorged females were taken on 15th August. After this the females became scarce in day-time shelters, but a few with developed fat-bodies were taken daily until the observations were discontinued. Adults of *A. hyrcanus* were most abundant at the beginning of August, and continued to feed and develop eggs throughout most of September. No female in a state of gonotrophic dissociation or with a developed fat-body was found.

During the day the mosquitos sheltered in inhabited houses, huts, tents and animal quarters and in the open. Very few males were taken, in spite of the proximity of the breeding places. More than five times as many Anophelines were taken in cow-sheds as in dwellings ; the two species were equally numerous in the dwellings, but *A. maculipennis* was the more abundant in the cow-sheds. The females of *A. maculipennis* were in various stages of blood digestion, whereas those of *A. hyrcanus* were in the initial ones only, which indicated that they entered shelters in search of food but did not stay there to complete digestion. Precipitin tests showed that only 10–15 per cent. of the females of *A. hyrcanus* fed on man ; *A. maculipennis* also fed chiefly on domestic animals, but 50 per cent. of those taken in dwellings contained human blood. More females of *A. hyrcanus* were attracted to a calf in the open than to one in a shed, while the reverse was true of *A. maculipennis*.

In the Russian Far East as a whole, the amount of malaria appears to depend on the prevalence of *A. maculipennis*, which is scarce in Blagoveshchensk. *A. hyrcanus* is numerous, but feeds mostly on animals, and its chances of contact with man are decreased by its tendency to feed outdoors. In addition, favourable conditions for the development of malaria parasites in mosquitos occur during only part of the period of maximum abundance of *A. hyrcanus*.

[TROFIMOV (G. K.).] **Трофимов (Г. К.). The physiological Condition of** *A. pulcherrimus* **Females in Autumn, according to Observations at Udjari, Transcaucasus Railway.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 62–64, 2 figs. Moscow, 1941. [Recd. 1943.]

In view of doubt as to whether *Anopheles pulcherrimus*, Theo., hibernates in Transcaucasia in the adult or larval stage, observations on the occurrence of the adults in shelters (chiefly animal quarters) were carried out from October 1937 to the end of January 1938 in a village in the semi-desert zone of the Shirvan steppe in Azerbaijan. They were found in fair numbers in the second half of October at a mean temperature of 14·2°C. [57·56°F.], but the great majority were still feeding and maturing eggs. In November, when the mean temperature of the air fell gradually from 13·4°C. [56·12°F.] to 10·1°C.

[50·18°F.], they were much less numerous in the shelters than *A. maculipennis*, Mg., but had apparently entered hibernation as they had undeveloped ovaries and, in most cases, a well-developed fat-body. They could, however, no longer be found in January, possibly because they had not survived cold weather in December, when the mean maximum temperature was 6·6°C. [43·88°F.] and the mean minimum –3·5°C. [25·7°F.].

[PRENDEL' (A. R.).] **Прендель (А. Р.). The Distribution of Subspecies of *Anopheles maculipennis* in South-west Ukraine.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 65–70, 1 map, 31 refs. Moscow, 1941. [Recd. 1943.]

The examination of 12,500 batches of eggs laid by females of *Anopheles maculipennis*, Mg., taken in various localities in the south-western Ukraine in 1935–39 showed that in general var. *messeae*, Flni., predominates in the forest-steppe zone between the Dnieper and the Bug and is associated with fresh standing water, var. *typicus* is also widely distributed, but is most numerous in association with flowing water fed by springs where ravines and granite formations occur, and var. *atroparvus*, van Thiel, which was by far the most numerous, is predominant in the Black Sea steppe, where brackish water is available, and is also abundant much further north in the districts in which rice is cultivated and in the valley of the Ingul, where the waters are only slightly saline. The distribution and abundance of the three varieties are shown in tables and on a map.

[PAVLOV (S. M.) & TEMERTE (F. V.).] **Павлов (С. М.) и Темерте (Ф. В.). On the Subspecies of *A. maculipennis* in Stalino Province, Donetz Coalfields.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 70–73. Moscow, 1941. [Recd. 1943.]

Of 4,901 batches of eggs laid by females of *Anopheles maculipennis*, Mg., taken in 1936–39 in day-time shelters in five districts in the Province of Stalino (south-eastern Ukraine), 44·3, 37·5 and 18·2 per cent. belonged to vars. *atroparvus*, van Thiel, *messeae*, Flni., and *typicus*, respectively. On the basis of topography and climate, the Province is divided into three zones, the maritime zone on the coast of the Sea of Azov (which is the warmest), the central steppe zone (which is the coldest), and the forest zone in the north. All three varieties occurred in all districts, except Slavyansk (in the north), from which *atroparvus* was absent, but var. *typicus* was abundant only in the flooded areas in the forest zone and certain areas in the steppe zone, where it predominated. Var. *atroparvus* occurred more frequently towards the south and var. *messeae* in the north. Most of the egg-batches laid in March, April and May belonged to var. *messeae*, whereas those laid in July, August and September were mostly var. *atroparvus*. Active and freshly fed females of var. *typicus* were taken on two occasions in cow-sheds in January, though the temperature outdoors was —35°C. [—31°F.].

[KARPOVICH (A. I.) & DOBRUININA (L. I.).] **Карпович (А. И.) и Добрынина (Л. И.). The Subspecies of *A. maculipennis* and their Biology in Stalinsk, Kuznetzk Coalfields (Siberia).** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 74–77, 1 graph. Moscow, 1941. [Recd. 1943.]

Investigations from October 1938 to September 1939 in and round the town of Stalinsk (south-western Siberia) showed that *Anopheles maculipennis*, Mg., was represented by vars. *typicus* and *messeae*, Flni., the latter being the more numerous. Hibernating females occurred chiefly in basements of old wooden houses in which the temperature varied from 9 to –18°C. [48·2 to –0·4°F.] and in pits in which vegetables were stored. Some of the mosquitos found were

frozen to the walls and ceiling, but after careful thawing they revived and many subsequently fed and laid eggs. Females taken from their hibernation quarters and kept in the laboratory at temperatures varying from 6 to 22°C. [42·8–71·6°F.] took blood mostly on the second day. Of the 229 egg-batches obtained from them, 13 belonged to var. *typicus* and the rest to var. *messeae*, indicating that the former hibernates chiefly in the open. Most of the mosquitos oviposited after only one or two blood meals, but a few required 4–5 in the early winter.

The last females containing blood were taken in day-time shelters on 23rd September and the last males on the 22nd. The mosquitos began to abandon their hibernation quarters on 14th April, and the first summer adults were caught on 13th June. During the day they usually rested in cow-sheds and pig-sties, and only occasionally in dwellings. Of 1,070 egg-batches examined during the summer, 72·9 per cent. belonged to var. *messeae*, which was only slightly more numerous than *typicus* in June but became much more so in July and August. No eggs of var. *typicus* were observed in September, probably because the females had entered diapause.

[KESHISH'YAN (M. N.).] **Кешишьян (М. Н.). Culicidae of Tadjikistan.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 77–80. Moscow, 1941. [Recd. 1943.]

A list is given of the 26 species of mosquitos that have been found in Tadzhikistan, with notes on their local distribution and abundance. The Anophelines comprise *Anopheles claviger*, Mg. (*bifurcatus*, auct.), *A. superpictus*, Grassi, *A. algeriensis*, Theo., *A. maculipennis* var. *sacharovi*, Favr, *A. lindesayi*, Giles, *A. sogdianus*, Keshish'yan, *A. barianensis*, James, *A. hyrcanus*, Pall., *A. h. mahmuti*, Mart., and *A. pulcherrimus*, Theo. The chief vectors of malaria are *A. superpictus* and *A. m. sacharovi* ; *A. pulcherrimus* is less important because it hibernates in the larval stage and therefore ceases to be active relatively early in the season. *Culex univittatus*, Theo., and *Theobaldia indica*, Edw., are recorded for the first time from Tadzhikistan and the Russian Union, respectively.

[OVCHINNIKOV (K. M.).] **Овчинников (К. М.). The principal Lines of Mosquito Control on Ponds and large artificial Lakes by Means of physical Methods.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 80–87. Moscow, 1941. [Recd. 1943.]

In view of the large numbers of reservoirs that have recently been constructed in the Russian Union, the author discusses measures that will make them unsuitable for Anopheline breeding. Since the larvae thrive in shallow water, reservoirs should be at least 6 ft. deep, and flooding should be prevented by mounding the banks and providing them with drainage. If the banks are sloping, their lower portions should be deepened and strengthened, and the sides should be even to prevent the formation of small inlets. Accumulation of silt can be prevented by constructing weirs in the stream that feeds the reservoir and by terracing or planting trees on the slopes of ravines. To promote wave action, which is unfavourable for mosquito breeding and the development of aquatic vegetation, reservoirs should be wide and exposed to wind, and obstacles tending to break the waves should be removed. The larvae can be killed by periodical fluctuations in the water level, and by complete draining and drying of the bottom.

[PETROVSKIĬ (G. S.).] **Петровский (Г. С.). The Winter Draining of Ponds and its Effect upon the Population of Anopheline Larvae.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 87–90. Moscow, 1941. [Recd. 1943.]

Observations in the district of Uman', Province of Kiev, showed that the chief breeding places of Anophelines there are ponds overgrown with aquatic vegetation. Ponds that were drained in autumn and refilled in spring contained

relatively few larvae in the following summer because the vegetation in them was killed by the winter cold and did not reappear till August or September. Draining was more effective and cheaper than removal of the vegetation by hand, and is therefore recommended. Mill ponds should be drained for 3–4 weeks in April or May, while the mill is being overhauled, as, though this does not kill all the aquatic vegetation, it retards its growth so that conditions will be unfavourable for breeding until midsummer.

[Biryukov (V. I.)] **Бирюков (В. И.). The Lowering of the Water Level in Ponds and its Effect upon the Life of *Anopheles* Larvae.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 90–93, 1 fig. Moscow, 1941. [Recd. 1943.]

Experiments on the control of larvae of *Anopheles* [*maculipennis*, Mg.] by altering the water level in two large reservoirs were carried out in the summer of 1938 in the Province of Kharkov. The banks were covered with vegetation and larvae were abundant. The water level was lowered by 1 ft. or more on each of four dates within about a month, so that it was some 4–5 ft. lower at the end than at the beginning. Each successive reduction exposed a fairly wide strip of the bank, and the aquatic vegetation and larvae and pupae at the edges were stranded. Very few larvae were subsequently recovered from the water. Subsidiary experiments showed that reduction of the water level was most effective against larvae in the first two instars, and that floating vegetation, some of which remained in the water and retained the larvae, reduced its effectiveness.

In an editorial note, it is emphasised that successive reductions of the water level as recommended by the author are effective only if they expose all the vegetation favourable for breeding.

[Dobrosmuislov (D. I.) & Korchagin (V. N.).] **Добросмыслов (Д. И.) и Корчагин (В. Н.). Thiodiphenylamine as a Substitute for arsenical Larvicides for the Control of *Anopheles* Larvae.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 93–96. Moscow, 1941. [Recd. 1943.]

In experiments in Moscow in 1939 to find a substitute for arsenical dusts for the control of larvae of *Anopheles maculipennis*, Mg., finely ground phenothiazine (thiodiphenylamine) gave complete mortality in the laboratory in 48 hours when applied at the rate of 1·35 lb. per acre in peat dust (1 : 13) and in 24 hours when applied at 0·9 lb. in talc (1 : 20). Paris green at the latter rate also killed all the larvae in 24 hours, and there was no mortality in any of the controls. In field experiments, phenothiazine similarly diluted in road dust or peat dust gave complete mortality in 30 hours when applied at 1·35 lb. at a temperature of 25–26°C. [77–78·8°F.], and 99·6 and 99·5 per cent. in 24 hours at 0·9 lb. and 23–24°C. [73·4–75·2] and 18°C. [64·4°F.], respectively, as compared with 99·8 for Paris green at 0·9 lb. and 25–26°C., and 97·5 for Shchelkovo green [*cf. R.A.E.*, B **26** 242] at 0·9 lb. and 18°C. At 18°C., the percentage mortality in the controls was 17. Phenothiazine at 0·9 lb. also gave 60 per cent. mortality of the larvae of *Culex*, as compared with a control mortality of 13·5 per cent., in 24 hours.

The action of phenothiazine is slower than that of Paris green, but this is of no practical importance under field conditions. Since it is not poisonous to man and domestic animals and is easily and cheaply prepared from products available in Russia, it is recommended as a mosquito larvicide.

[Pospelova-Shtrom (M. V.).] **Поспелова-Штром (М. В.). On the Factors controlling the Distribution of the Ticks, *Ornithodorus*—Vectors of Tick Relapsing Fever.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 96–100. Moscow, 1941. [Recd. 1943.]

Notes, based partly on the literature, are given on the habitats of various ticks of the genus *Ornithodoros* in the Russian Union, those dealt with comprising

O. tholozani, Lab. & Mégn. (*papillipes*, Bir.), *O. tartakovskyi*, Olenev, two species that were to be described as new, about which little is said, and an unidentified species from Daghestan. *O. tartakovskyi* occurs under the dry and warm conditions of the semi-desert and desert-steppe zone [*cf. R.A.E.*, B **31** 58] at the foot of mountains up to an altitude of approximately 1,650 ft., whereas *O. tholozani* is also found at altitudes of up to 5,000 ft. Each species is associated with habitats having a particular microclimate, usually characterised by high humidity and a temperature that is lower in summer and higher in winter than that of the surroundings. Thus, the temperature in a cave in Turkmenistan in which examples of *O. tholozani* were taken was 18–20°C. [64·4–68°F.] in both winter and summer, as compared with 55°C. [131°F.] at the entrance in summer, and the humidity was considerable and constant. The Daghestan species occurred in the burrows of foxes and in native buildings in which the average temperature in summer was 24–25°C. [75·2–77°F.] and the relative humidity 70–75 per cent., and not in the warmer and drier houses of the European type or in the burrows of rodents.

The suitability of a habitat also depends on the extent to which it shelters the ticks from enemies and mechanical disturbance and provides hosts. Since these ticks can live a long time (over 9 years in the case of *O. tholozani*), oviposit at intervals and lay a much smaller total number of eggs than Ixodids, the durability of the habitat is important. The long-lived species usually occur under stones and in caves, cracks in rocks, the well-constructed burrows of large mammals, and stone buildings, whereas the comparatively short-lived *O. tartakovskyi* is associated with the less durable burrows of small animals. Another important factor is the number of different host animals that are attracted to a habitat, since the chief host of the habitat is often not the only source of nourishment for the ticks. They seldom concentrate in the furthest part of the burrow, but occur along the passage, since various animals visit the burrows in search of food or shelter and may remain there for a while. As the ticks can resist prolonged starvation (up to 4–6 years in the case of *O. tholozani*), they are not affected by the migrations of the hosts and survive even in uninhabited buildings. Their ability to engorge in a short time, rarely more than 20 minutes, enables them to abandon a temporary host and remain in a favourable habitat.

Though these ticks exist independently of man or domestic animals, some species can adapt themselves to human habitats, *O. tholozani* being the most adaptable. Owing to their slow locomotion, infrequent feeding and short sojourn on the host, however, they do not spread quickly and are frequently absent from human habitats that would be suitable for them. They are probably spread by dogs and other domestic animals, or by mice, rats and other rodents, and dwellings and animal quarters should be made inaccessible to such animals and unsuitable as habitats for ticks.

[Shchurenkova (A. I.).] **Щуренкова (А. И.).** *Phlebotomus clydei* **Sinton 1928 in Tadjikistan.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 107–111, 2 figs., 12 refs. Moscow, 1941. [Recd. 1943.]

Sandflies collected in August 1939 from the burrows of rodents in south-western Tadzhikistan included 18 males and 19 females of *Phlebotomus clydei*, Sint., which has not previously been recorded from the Russian Union. It could not be found in dwellings, pig-sties or hen-houses. Descriptions are given of the adults of both sexes, including the external genitalia, buccal armature and pharynx of the male, and the pharynx and spermatheca of the female, together with characters distinguishing other species of the subgenus *Sintonius* from it.

[SHCHURENKOVA (A. I.).] **Щуренкова (А. И.). A Standard for Description of new Species of Sandflies.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 112–116. Moscow, 1941. [Recd. 1943.]

Many of the descriptions of new species and varieties of *Phlebotomus* that have appeared in recent years in the Russian Union ignore characters that are important for specific determination. Rules are therefore given, based on those proposed by França and Parrot [*R.A.E.*, B **9** 22], that should be followed in descriptions, with indications of the terminology to be used.

[MUDZHIRI (M. S.).] **Муджири (М. С.). Some Mosquitos from the Amur Railway.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 p. 132. Moscow, 1941. [Recd. 1943.]

Records are given of the mosquitos taken in the summer of 1936 at 11 places along the railway from Mogocha to Bureya in the Russian Far East. The Anophelines found were *Anopheles hyrcanus*, Pall., including var. *mesopotamiae*, Chr. & K.C., which occurred at ten of the places and was abundant on the eastern part of the line, and *A. maculipennis*, Mg., which was scarce there but much more numerous than *A. hyrcanus* in the western part.

[ANISIMOVA (M. M.).] **Анисимова (М. М.). Some Mosquitos from the Region of the new Akmolinsk-Kartaly Railway.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 132–133. Moscow, 1941. [Recd. 1943.]

A list is given of mosquitos found in the summer of 1939 in northern Kazakstan along the railway that was being built between Kartalui and Akmolinsk. The only Anopheline was *Anopheles maculipennis*, Mg., and 15 egg-batches collected at six different points all belonged to var. *messeae*, Flni. Favourable conditions for its breeding were afforded by rivers, stagnant water overgrown with aquatic vegetation in valleys, and temporary and permanent lakes, the larvae occurring in waters containing 0·7–5·4 parts mineral salts per mille.

[BOZHENKO (V. P.).] **Боженко (В. П.). On the Distribution of *A. hyrcanus* in Kazakhstan.** [*In Russian.*]—*Med. Parasitol.* **10** no. 1 pp. 133–134. Moscow, 1941. [Recd. 1943.]

In the course of malaria investigations in the summer of 1938 in the region of Lake Zaisan in eastern Kazakstan, it was found that *Anopheles hyrcanus*, Pall., was much more numerous than *A. maculipennis*, Mg. It was abundant all along the shore of the lake, and particularly so in inhabited places close to shallow open marshes and growths of reeds. It was also present along the banks of the Irtuish, which flows out of the lake and was surveyed for a distance of 68 miles, and larvae were found at a place some 25 miles east of the river. During the day, the adults sheltered in reeds and other vegetation and attacked cattle and man even in direct sunlight, though in smaller numbers than at night. In localities in which they were abundant they entered inhabited buildings after sunset and attacked man, but most of them left soon after sunrise, though single individuals of both sexes remained in the houses throughout the day. Larvae occurred in open shallow marshes and among reeds in the presence of aquatic vegetation. Swarms of adults, which also included some of *A. maculipennis*, were carried over considerable distances by strong winds ; one large swarm was thus carried across the lake, a distance of some 8 miles. It is possible that the spread of *A. hyrcanus* downstream along the Irtuish may be effected by wind or by carriage on steamers ; adults of this species and *A. maculipennis* both entered the cabins of river steamers after sunset.

WANSON (M.). **Sur la biologie des phlébotomes congolais.**—*Rec. Trav. Sci. méd. Congo belge* 1942 no. 1 pp. 23–43, 2 pls., 6 figs., 66 refs. Léopoldville, 1942.

An account is given of breeding experiments with *Phlebotomus schwetzi*, Adl., Theo. & Parr., *P. africanus*, Newst., and *P. squamipleuris*, Newst., in the Belgian Congo to determine whether the larvae are phytophagous or coprophilous and thus assist in the discovery of their breeding places in nature. The adults are associated with latrines [*cf. R.A.E.*, B **25** 208], but the author has not found larvae in septic tanks or ditch latrines. The sandflies were bred on various media in lamp glasses placed on damp sand. In the first test, in which the medium was green moss and 6 engorged females were placed in each glass, only 48 adult offspring were obtained from 60 females. The humidity was therefore reduced and the females enclosed separately. Under these conditions, one female gave rise to 21 adults. In further tests, 19–24 adults per female were obtained on ordinary soil, 20–25 on vegetable débris, chiefly dried leaves [*cf.* **31** 81], and 25–28 on the dried mud, largely cellulose, from the bottom of septic tanks. No larvae developed, though the females oviposited, on soil mixed with blood, lizard droppings, green leaves, powdered cockroach, fresh or dried cow dung or faecal matter from latrines. At 28°C. [82·4°F.], the larval and pupal stages lasted 35–40 and 8–14 days, and complete development 51–56 days. Three pupae from a crack in the soil near a latrine at Matadi yielded *P. africanus*, *P. schwetzi* and *P. squamipleuris*, and other places in the vicinity of water closets and ditch latrines gave, besides these, *P. africanus niger*, Parr. & Schwetz, and *P. wansoni*, Parr.

Lists are given showing the species and numbers of adult sandflies caught in various environments at Matadi and Thysville ; in all, 9 species were represented. Those taken in and near human habitations in the early morning were mainly *P. africanus*, *P. africanus niger* and *P. schwetzi*. They abounded in latrines shaded by vegetation and in bathrooms and latrines in houses, but were not observed in public latrines, which were well lighted and airy. The feeding preferences of the sandflies were determined by precipitin reaction, the technique of which is described, and positive results were obtained with five species. They showed that *P. schwetzi* feeds equally on man and on warm and cold blooded animals. *P. africanus*, which attacks man exceptionally, feeds normally on small lizards, as do also *P. africanus niger*, *P. dureni*, Parr., *P. collarti*, Adl., Theo. & Parr., and *P. wansoni*, while *P. mirabilis*, Parr. & Wns., and *P. gigas*, Parr. & Schwetz, feed on bats.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). **Recherches sur le comportement du *Trypanosoma gambiense* chez le porc.**—*Rec. Trav. Sci. méd. Congo belge* 1942 no. 1 pp. 53–68, 6 refs. Léopoldville, 1942.

The following is based on the authors' summary of the results of further investigations in the Belgian Congo on the native pig as a reservoir of *Trypanosoma gambiense* [*cf. R.A.E.*, B **26** 73]. The trypanosome remained pathogenic to man after three and after ten cyclical passages by means of *Glossina palpalis*, R.-D., in pigs. The index of transmissibility [*cf.* **22** 126] increased from almost 5 to over 6 during the early passages, but gradually fell to less than 1, though there was a rise to over 2 in some of the later passages. The decrease is attributed to the persistence of the trypanosome in the same species of vertebrate host and to the mildness of the infection produced. When a different vertebrate host was introduced, transmissibility was restored. In the pig, cyclical transmissibility gradually weakened during the development of the disease and was generally low after 200 days. *T. gambiense* produces an asymptomatic infection in pigs, which develops to spontaneous cure. Re-infection sometimes occurs, even with the same strain, but gives a milder infection, or is sometimes prevented by immunisation, though such pigs are not immune from *T. brucei*.

The first sign of infection is usually the occurrence of trypanosomes in the blood, but even though this does not occur, the animal is nevertheless a source of infection and may remain so for at least a year. In the course of successive cyclical passages through ten pigs, the trypanosomes underwent no significant changes in morphology or resistance to arsenic.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). **Irrégularités de la transmission du** *Trypanosoma gambiense* **par** *G. palpalis.*—*Rec. Trav. Sci. méd. Congo belge* 1942 no. 1 pp. 69–80, 16 refs. Léopoldville, 1942.

The following is taken from the authors' summary of investigations on irregularities in the transmission of *Trypanosoma gambiense* to laboratory animals by *Glossina palpalis*, R.-D. Among animals that are very susceptible to the trypanosome, such as guineapigs, some escape infection following the bite of an infective fly. This may be due to temporary resistance in the guineapig, a change in the pathogenicity of the trypanosome or possibly some morphological or physiological obstacle in the fly itself. The incubation period of the trypanosome in guineapigs may be as long as 86 days. One of the strains of trypanosomes tested was obtained from a patient who had been infected for more than 10 years. Guineapigs bitten by flies infected from this source remained unaffected.

KLOSTERMEYER (E. C.). **Roach Powders. Study of comparative Effectiveness of insecticidal Powder Mixtures against the German Cockroach.**—*Soap* **19** no. 2 pp. 98–99, 109, 1 graph, 6 refs. New York, N.Y., 1943.

An account is given of investigations on the relative toxicities of several dusts to adults of *Blattella germanica*, L., of mixed ages [*cf. R.A.E.*, B **26** 246]. The tests were made in a bell jar set on a wooden platform through a hole in which weighed amounts of the dusts adjusted to give a deposit of 0·38 mg. per sq. cm. in 5 minutes were introduced by means of a glass atomiser dust gun. The cockroaches were placed under the bell jar in dishes with greased rims to prevent their escape and false bottoms of wire gauze to prevent their coming into contact with more dust than fell on them, and were subjected to the settling dust for five minutes. Abbott's formula [A **13** 331] was used to compute the percentage kill at the end of 10 days. The dusts tested, with the percentages of females killed shown in brackets after each, were sodium fluoride and pyrethrum containing 0·9 per cent. pyrethrins at 3 : 1 (99·2) and 1 : 1 (98·4), borax (95·0), borax and pyrethrum at 3 : 1 (93·8), sodium fluosilicate and pyrethrum at 3 : 1 (93·4), sodium fluosilicate (91·2), borax and pyrethrum at 1 : 1 (89·8), sodium fluoride (89·6), sodium fluosilicate and pyrethrum at 1 : 1 (88·6), sodium fluoride and pyrethrum at 1 : 3 (86·0), sodium fluoride and pyrophyllite (Pyrax ABB) at 1 : 1 (85·2), sodium fluosilicate and pyrethrum at 1 : 3 (80·8), sodium fluoride and pyrophyllite at 3 : 1 (76·8) and 1 : 3 (68·6), pyrethrum (31·6), borax and pyrethrum at 1 : 3 (23·4) and pyrophyllite (13·4). Mortality among controls was 3·0 per cent., and a difference of 9·55 per cent. is significant. Mortality among treated and untreated males was considerably higher. Sodium fluoride killed more rapidly than pyrethrum or sodium fluosilicate, and the action of borax was very slow. The addition of pyrethrum greatly increased the rate of action of sodium fluoride and also increased that of sodium fluosilicate, but scarcely affected that of borax. There was evidence that the lethal action of the sodium fluoride was the result of penetration of the integument and not ingestion [*cf.* B **30** 194].

Kearns (C. W.) & March (R. B.). **Small Chamber Method for testing Effectiveness of Insecticides against Houseflies.**—*Soap* **19** no. 2 pp. 101, 103–104, 128, 6 figs. New York, N.Y., 1943.

A detailed description and illustrations are given of an apparatus designed to test the toxicity of insecticides to the house-fly [*Musca domestica*, L.] quickly, simply and cheaply. It consists of a horizontal glass cylinder, 26 ins. long and 12 ins. in diameter, into which the spray is introduced through two glass atomisers operated by compressed air and mounted in the centres of the doors forming the ends of the cylinder, which are of either wood or gauze. Each atomiser is adjusted to deliver 1 cc. of refined kerosene in 7 seconds, and the amount of solution used in it is 0·4 cc. if the cylinder has solid doors and 0·6 cc. if it has gauze ones. Paper towels on the bottom of the spray chamber absorb the spray deposit. Flies are introduced into the cylinder through a special aperture in one of the doors after the atomisers have been loaded, and the aperture is then closed and the spray delivered. The paralysed flies are picked up and counted after 10 minutes and the percentage kill determined 24 hours later.

The results are given of tests in which three insecticides, chosen on account of their different physical properties, were compared in both variations of the small chamber and in the Peet-Grady chamber [*R.A.E.*, B **16** 255]. They indicate that there is no significant difference between results obtained in the small chamber with gauze doors and those obtained in the Peet-Grady chamber and that the small chamber with solid doors may favour compounds having a high vapour pressure. It is thought that the use of the small chamber as a supplement to the Peet-Grady method would save time and be particularly appropriate for preliminary tests of compounds of unknown value.

Dunnahoo (G. L.). **Insect Control on Aircraft.**—*Soap* **19** no. 2 pp. 111, 113. New York, N.Y., 1943.

The history of the control of mosquitos and other insects in aircraft is reviewed [*R.A.E.*, B **20** 51 ; **27** 118 ; **28** 245, etc.], and the setting up of disinfestation stations in Trinidad, Venezuela and Colombia and of inspection stations in Porto Rico, Haiti and Jamaica to cover all air routes from South America to the United States is reported. These stations were maintained from 1st November 1940 to 30th June 1941 by the United States Public Health Service and subsequently by Pan American Airways. The inspection reports for the first eight months are summarised. During this time, only two live mosquitos were found in the 208 aircraft from South America when they arrived at the port next after the one at which they had been treated. In experiments undertaken to improve the insecticide used in order to reduce the time of application and increase kill of more resistant species, it was found that the quantity of pyrethrum necessary to give complete kill of *Aëdes aegypti*, L., remained fairly constant regardless of the strength of insecticide prepared. To reduce the quantity of oil introduced into the aircraft, standard pyrethrum concentrate was used undiluted. Complete kill of mosquitos resulted when the pyrethrum extract was introduced at the rate of 5 cc. per 1,000 cu. ft. with power spraying apparatus producing a fine atomisation and the aircraft kept sealed for two minutes. When hand spraying apparatus was used, it was necessary to increase the rate to 8 cc. Pan American Airways has ordered that all aircraft must be disinfested between all ports. The pyrethrum is projected with dichlorodifluoromethane [**31** 136], the mixture containing 2 per cent. pyrethrins, from a commercially available sprayer adapted as a refillable dispenser. With it, complete kill of mosquitos is obtained by operating for 3 seconds per 1,000 cu. ft. with an exposure of 2 minutes. The method of refilling is briefly described.

Goodhue (L. D.). **Insecticidal Aerosol Production. Spraying Solutions in liquefied Gases.**—*Industr. Engng Chem.* **34** no. 12 pp. 1456–1459, 6 figs., 15 refs. Easton, Pa., 1942.

The author describes a method of producing aerosols without heat, in which the insecticide, dissolved in a suitable liquefied gas in a closed container, is released through a spray nozzle [*cf. R.A.E.*, B **31** 136] ; after being forced through the nozzle by its own pressure, the solvent forms the aerosol by evaporating rapidly, the heat of vaporisation being supplied from the atmosphere. The delivery tube must reach to the bottom of the liquid, since the solution and not the gas must be sprayed, and to avoid a coarse wet spray, the components of the solvent must be gaseous at temperatures considerably below that at which spraying is carried out.

An aerosol of pyrethrum extract and sesame oil, produced by spraying a solution of 5 gm. purified pyrethrum extract (20 per cent. total pyrethrins) and 2 gm. refined sesame oil in 93 gm. dichlorodifluoromethane, which has a pressure of nearly 90 lb. per sq. in. at room temperature, has been tested with promising results against various Diptera. It is very toxic to mosquitos, particularly *Aëdes aegypti*, L., which is killed in two minutes when as little as 5 mg. pyrethrins and 10 mg. sesame oil are suspended in 1,000 cu. ft. of air, and readily controls house-flies [*Musca domestica*, L.] and flies associated with dairy farms. Some irritation of the respiratory tract is caused by ordinary commercial pyrethrum extracts applied in aerosol form, but this appears to be due to a constituent other than the pyrethrins [*cf.* A **29** 528], and was reduced in samples that were purified by molecular distillation.

Methyl chloride has a pressure of about 80 lb. per sq. in. at room temperatures and will dissolve many more insecticides and is less expensive than dichlorodifluoromethane, but its use for the dispersion of insecticides in the form of aerosols depends on its safety, as it is weakly combustible and slightly toxic to man [*cf.* B **31** 136].

A laboratory method of determining the settling rates of aerosols and sprays is described, and the settling rates of the dichlorodifluoromethane aerosol and one produced by spraying a similar solution of pyrethrum and sesame oil in deodorised kerosene on a hot plate [*cf.* B **28** 239 ; **30** 70] and of the mist given by the second solution when it was sprayed through a standard Peet-Grady nozzle at a pressure of 12·5 lb. per sq. in. are shown on a graph. The aerosol produced by heat settled more slowly than the other, but both remained suspended much longer than the mist. Different types of nozzles, methods of spraying and materials influenced the settling rates in all cases.

Twinn (C. R.) & MacNay (C. G.). **The Control of Pediculosis and Scabies by means of Preparations containing Pyrethrins, Rotenone, and aliphatic Thiocyanates.**—*Canad. Ent.* **75** no. 1 pp. 4–13, 5 refs. Guelph, Ont., 1943.

The results are given of tests of preparations containing rotenone, pyrethrum and aliphatic thiocyanates made against the head louse, *Pediculus humanus capitis*, DeG. (*P. h. humanus*, L.) on school children and against scabies (*Sarcoptes scabiei*, DeG.) and crab lice (*Phthirus pubis*, L.) on soldiers in Ontario in 1941 and 1942. The preparations used were Lethane 384 Special (12½ per cent. *n*-butyl carbitol thiocyanate and 37½ per cent. beta-thiocyanoethyl esters of aliphatic fatty acids by volume in a refined kerosene base) [*cf. R.A.E.*, B **31** 81], concentrated extracts of pyrethrum, and derris extracts containing 5 per cent. rotenone. All these at various concentrations in deodorised kerosene and the derris extract in olive oil quickly killed head lice and their eggs. The Lethane and pyrethrum extracts were effective at concentrations as low as 5 per cent.

Lethane and 0·12 per cent. pyrethrins, respectively, but for general use higher concentrations are probably desirable. The derris extract was effective at 0·5 per cent. rotenone, and derris powder containing 5 per cent. rotenone was also effective. Sta-Way (which contains diethylene glycol monobutyl ether acetate and diethylene glycol monoethyl ether [*cf.* **29** 65, 143]) killed the lice on contact, but results were less conclusive than with the other materials. The liquids were applied at the rate of ¼ fl. oz. per head on girls and about half as much on boys, and derris powder at one level teaspoonful per head on girls. No discomfort or ill effect from the use of any of the preparations was reported. The cost of materials for each treatment was less than one cent except when Sta-Way was used.

All infestations of *P. pubis* and 90 per cent. of cases of scabies were effectively treated by one application of an ointment containing 10–50 per cent. Lethane or pyrethrum or derris extract at concentrations ranging from 0·6 to 1·8 per cent. pyrethrins and 0·5 to 2·5 per cent. rotenone, and the remaining cases of scabies were cured by a second application. Lotions of pyrethrum extract or Lethane in an equal quantity of olive oil were also effective, but ointments were preferred. Scrubbing or shaving the affected parts before treatment proved unnecessary and undesirable, the former process, at least, being an important contributing factor to skin irritation, especially with ointments containing Lethane or derris extract. Reduction of the concentration of these materials decreased the tendency of the ointments to irritate the skin, without impairing their effectiveness. The pyrethrum preparations caused little or no discomfort, even when the skin had first been washed or scrubbed.

Papers noticed by Title only.

Haseman (L.). **The Courting Flights of Tabanids.**—*Science* **97** no. 2517 pp. 285–286, 2 refs. Lancaster, Pa., 1943.

De Meillon (B.). **Simulidae e Ceratopogonidae (Dipt. Nematocera) da Colónia de Moçambique.** [The Simuliids and Ceratopogonids of Mozambique (including 5 new Ceratopogonids).] —27 pp., 4 pls. Lourenço Marques, Estaç. anti-malár., 1942.

Rozeboom (L. E.). *Phlebotomus anduzei,* **a new** *Phlebotomus* **from Venezuela.**—*Bol. Ent. venezolana* **1** no. 4 pp. 91–94, 4 figs., 8 refs. Caracas, 1942.

Ewing (H. E.) & Fox (I.). **The Fleas of North America. Classification, Identification, and geographic Distribution of these injurious and Disease-spreading Insects.**—*Misc. Publ. U.S. Dep. Agric.* no. 500, 142 pp., 13 figs., 91 refs. Washington, D.C., 1943.

Dade (H. A.). **Colour Terminology in Biology.**—*Mycol. Pap.* no. 6, 21 pp., 2 charts, 4 refs. Kew, Imp. Mycol. Inst., 1943. Price 3*s*. 9*d*.

KUMM (H. W.). *Anopheles crucians* **found in northern Nicaragua.**—*Amer. J. trop. Med.* **22** no. 5 pp. 511–512, 1 map, 5 refs. Baltimore, Md., 1942.

Anophelines found by the author during a brief visit to northern Nicaragua in 1941 comprised *Anopheles albimanus*, Wied., *A. argyritarsis*, R.-D., *A. strodei*, Root, *A. punctimacula*, D. & K., and *A. crucians*, Wied. This is believed to be the first record of the last three for Nicaragua and the southernmost record for *A. crucians*.

BANG (F.) & SIMPSON (T.). **Feeding Habits of** *Anopheles walkeri* **Theobald at Reelfoot Lake, Tennessee.**—*Amer. J. trop. Med.* **22** no. 5 pp. 513–516, 13 refs. Baltimore, Md., 1942.

Precipitin tests on 105 females of *Anopheles walkeri*, Theo., caught at Reelfoot Lake, Tennessee, in 1938–41, mostly in a cow-shed, showed that 65 had fed on cow, 25 on horse, 9 on man, 6 on pig, dog, sheep or fowl, and none on rabbit. The percentages of four other Anophelines found to contain human blood by workers in various parts of the United States are given in a table. They show that great variation exists within a species even when a large number of specimens is available. In preferential feeding experiments, man, pig, cow and fowls attracted 6·8, 4·0, 2·5 and 0 females of *A. walkeri* per test, respectively, and field observations have shown that man is attacked in the presence of cows or horses. In tests with small animals in gauze funnel traps, pig and rabbit attracted 3·4 and 0·5 females per test, respectively, or totals of 17 and 1, but no females were attracted to opossum in two tests.

RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **Observations on Longevity of** *Anopheles culicifacies* **Imagines.**—*Amer. J. trop. Med.* **22** no. 5 pp. 517–533, 2 figs., 3 graphs, 24 refs. Baltimore, Md., 1942.

The literature on the duration of adult life of mosquitos is reviewed. To study the length of life of *Anopheles culicifacies*, Giles, in south-eastern Madras, where it is the chief vector of malaria, 10,412 newly emerged and marked adults were released between 30th April and 24th October 1941 in 16 batches in a large outdoor screen insectary near Pattukkottai [*R.A.E.*, B **31** 75], in which climatic and other conditions were similar to those outside. The larger natural enemies of mosquitos were absent, but ants, spiders and Hydrachnids were often found. The maximum survival periods of the females varied from 8 to 34 days, increasing as the season advanced and temperature became slightly lower and relative humidity considerably higher. The longest time a male was observed to live was 8 days. Investigation of the rate of mortality in batches released between August and October, when the maximum periods of survival were 21–34 days, showed that at least half the females had died by the third day, and that reduction in population was approximately by geometrical progression, or 50 per cent. every other day. The probable and average durations of life were thus only two and four days, but there were always one or two individuals in each batch that lived considerably longer than the rest. These findings are compared with field observations in the Punjab [**29** 5], with which they are in general agreement. Low relative humidity in the Punjab was apparently accompanied by low mean temperatures, and the high humidity in Pattukkottai was accompanied by a temperature of about 84°F. As 97 per cent. of the females die before the tenth day, only 3 per cent. have any chance of transmitting malaria. In nature, a rapid rise in the numbers of adults of *A. culicifacies* occurs in June–July, immediately after irrigation is begun [*cf.* **29** 147 ; **30** 121]. This must be due to the large increase in the area of available breeding places, since the season is unfavourable to adult survival and the emergence rate from breeding places has been found to be low.

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RUSSELL (P. F.) & RAMACHANDRA RAO (T.). **A Study of Density of** *Anopheles culicifacies* **in Relation to Malaria Endemicity.**—*Amer. J. trop. Med.* **22** no. 5 pp. 535–558, 5 figs., 22 refs. Baltimore, Md., 1942.

Theories on the phenomenon of the absence of malaria from regions where Anophelines occur are reviewed and discussed, and an account is given of observations made over a period of two years (1939–41) in eight comparable villages in south-eastern Madras, four in Pattukkottai taluk, where malaria is endemic, and four in the adjacent non-malarious Tanjore delta. The Anophelines taken in the delta were the same as those those taken in the taluk [*cf. R.A.E.*, B **30** 172], except that *Anopheles stephensi*, List., was not found. *A. culicifacies*, Giles, is the vector of malaria in the taluk [**27** 44], where it is exceedingly abundant during the irrigation season [*cf.* preceding abstract] but has an infection index of only about 0·1 and prefers bovine to human blood. Of 402 females from the taluk and 460 from the delta that gave positive results in precipitin tests, only 10 and 12 contained human blood, the proportion being thus almost the same. No differences in the morphology of the eggs, larvae, pupae or adults, in susceptibility to infection by *Plasmodium falciparum* or in resting habits were found between examples from the two localities, but collections in human dwellings and animal shelters and the catch in uniform calf-baited traps indicated that the density of *A. culicifacies* was 3–4 times as great in the taluk. This was shown to be due to the much smaller number and extent of suitable breeding places in the delta, and not to differences in larval ecology [*cf.* **27** 44]. Out of the 12,380 larvae of *A. culicifacies* collected in the delta, 4,352 (the greatest number taken in any one habitat) were found in river-bed pools, mostly in the dry season when these were the only breeding places available. The main sources of larvae in the irrigation season were wells, which yielded 2,425, and branch irrigation canals and distribution channels, from which only 1,981 were collected. When streams were flowing, no larvae were found in the main river and only a few in smaller branches. Intensive agricultural practice apparently accounts for the scarcity of breeding places in the delta, as fallow flooded fields, a prolific source of *A. culicifacies* in the taluk, are practically non-existent. The observations made bear out the view that there must be a critical density of a malaria vector below which no transmission will occur. In south-eastern Madras, this critical density probably varies according to the rate of infection between about 5·0 and 10·0 per man hour with the methods of collection used in this work.

RUSSELL (P. F.) & BALARAMA MENON (P.). **On the Transmission of** *Plasmodium gallinaceum* **to Mosquitoes.**—*Amer. J. trop. Med.* **22** no. 5 pp. 559–563, 3 figs., 8 refs. Baltimore, Md., 1942.

The results of 2,209 dissections of mosquitos of 13 species fed in 23 lots on fowls infected with *Plasmodium gallinaceum* and then kept at a temperature of 70–85°F. and a relative humidity of 70–80 per cent. with rabbits for food are tabulated. Sporozoite infections, usually in all the individuals, were obtained in nearly all the batches of *Armigeres obturbans*, Wlk., and *Aëdes albopictus*, Skuse, and these species also easily transmitted the infection to fowls, but none of the 417 females of *Anopheles* dissected (which belonged to seven species) had become infected, although some were fed at the same time and on the same birds as *Armigeres* and *Aëdes*. One gut infection was observed in 35 dissection of *Culex mimuloides*, Barraud, but 9 dissections of *C. raptor*, Edw., 12 of *C. mimeticus*, Noé, and 791 of *C. fatigans*, Wied., were all negative [*cf. R.A.E.*, B **29** 195]. Since it was recorded that 12 species of *Armigeres* and *Aëdes* had been experimentally infected [**30** 191], *Armigeres annulipalpis*, Theo., *A. magnus*, Theo., *Aëdes vexans*, Mg., *A. jamesi*, Edw., and *A. albolateralis*, Theo., have been tested, all with positive results. Whereas *A. albopictus* and *Armigeres*

obturbans fed avidly on the heads, legs and toes of fowls, *Anopheles stephensi*, List., sometimes fed on the head but could not pierce the skin of the legs or toes and *C. mimuloides* fed only reluctantly, even on a part of the back from which the feathers had been removed. It is concluded from these results that species of *Anopheles* and *Culex* are not natural hosts of *P. gallinaceum* in southern India and that there is little danger of infections with this *Plasmodium* invalidating data obtained in surveys on human malaria there.

TRAGER (W.). **A Strain of the Mosquito *Aëdes aegypti* selected for Susceptibility to the Avian Malaria Parasite** *Plasmodium lophurae.*—*J. Parasit.* **28** no. 6 pp. 457–465, 23 refs. Lancaster, Pa., 1942.

The following is the author's summary. By selective breeding from infected females, a strain of *Aëdes aegypti*, L., was produced which, after more than a year of mass, non-selective breeding, has maintained its character of being much more susceptible to infection with *Plasmodium lophurae* than the stock from which it was derived.

EWING (H. E.). **Remarks on the Taxonomy of some American Chiggers (Trombiculinae), including the Descriptions of new Genera and Species.**—*J. Parasit.* **28** no. 6 pp. 485–492, 1 pl., 13 refs. Lancaster, Pa., 1942.

In the course of this paper, the author discusses the nomenclature of the common North American chigger mite. He points out that if *Leptus rileyi*, Oudemans, is not a synonym of *Trombicula* (*Eutrombicula*) *alfreddugèsi*, Oudemans, *T. cinnabaris*, Ewing, and *L. similis*, Hirst, are both available names for it [*cf. R.A.E.*, B **28** 246 (note)]. *T. cinnabaris* probably has priority, but this is not certain, as though the printed date for it is 1920, the actual date of publication was in 1921. There is no doubt that the name *T. cinnabaris* applies to the common North American chigger, but the author knows of no good reason for not considering it a synonym of *T. alfreddugèsi* [*cf.* **27** 5].

S. Torres & W. Braga (*Trab. Secc. vet. Inst. Pesq. Agron. Pernambuco* 1938 pp. 171–172) described, as *Apolonia tigipioensis*, gen. et sp. n., a Brazilian chigger mite that enters the quills of very new feathers of fowls and produces nodules and lesions. The author has studied a sample of one of these nodules and many infested quills. The nodule was about half the size of a pea ; each infested quill had broken off near its base, and the remaining part contained a single chigger, which usually completely filled the lumen and always faced the basal end. Several specimens of the mite were cleared and mounted and were found to have the essential characters of *A. tigipioensis*. If this mite should spread from Brazil to other countries, it might become a poultry pest of major importance. The affinities of the genus, which is allied to *Leeuwenhoekia*, are briefly discussed.

EWING (H. E.). **The American Chiggers (Larvae of the Trombiculinae) of the Genus *Acariscus*, new Genus.**—*Proc. ent. Soc. Wash.* **45** no. 3 pp. 57–66, 1 fig., 1 ref. Washington, D.C., 1943.

Characters are given distinguishing *Acariscus*, gen. n., and *Eutrombicula* ; they are very closely allied [both being within the scope of *Trombicula, sens. lat.*], and their respective types are *T. flui*, van Thiel [*cf. R.A.E.*, B **29** 197] and the species considered by the author to be *T. alfreddugèsi*, Oudemans [see preceding abstract]. A key is given to the ten American species included in *Acariscus*, of which two are new, followed by descriptions of their distinguishing characters and records of their hosts and distribution. One of the new species, *A. masoni*, was taken on man in Florida and on other mammals and a snake in the south-eastern United States and Massachusetts.

THOMAS (E. W. P.). **Dermatitis due to** *Tyroglyphus longior*, **Gerv., var.** *castellanii* **Hirst, in Cheese Dust.**—*Brit. J. Derm.* **54** pp. 313–319, 2 figs., 17 refs. London, 1942.

An account is given of one of the recently noticed cases of dermatitis caused by *Tyrophagus putrescentiae* (*Tyroglyphus longior*) var. *castellanii*, Hirst [*R.A.E.*, B **31** 16], together with short notes on two of the others. A note by E. Browning comprising a description of the mite, a list of the Tyroglyphids that have been reported to cause skin trouble, a list of the substances attacked by Tyroglyphids and a bibliography is included. From the scarcity in the literature of references to dermatitis caused by food mites, which are widely distributed, it is concluded that as a rule these mites are harmless to the skin.

JOHNSON (C. G.). **Recent Research and the Scabies Problem.**—*J. R. sanit. Inst.* **63** no. 1 pp. 29–34, 6 refs. London, 1943.

The aims of current research on scabies are set out, and the life-history of *Sarcoptes* [*scabiei*, Deg.] is briefly described, attention being drawn to the lacunae in present knowledge. As the reproductive potential is very large and the number of mites on a patient is usually small [*R.A.E.*, B **31** 65, 128], there must be a high mortality in the early stages. It is also pointed out that there is no relationship between the number of mites and the severity of symptoms, and that there is an interval between infestation and the onset of irritation and appearance of the rash [*cf.* **31** 86]. The sites preferred by adult females are indicated [*cf.* **31** 65]. Various theories on transmission, a subject on which relatively little exact work has been done [*cf.* **29** 182; **30** 118, 145; **31** 69], are discussed. Attention is drawn to the lack of evidence of the existence of persons who are naturally immune or who carry the mites for a long time without developing symptoms of scabies. After a discussion of prophylaxis, it is concluded that widespread treatment of family units appears to be the most promising way of dealing with a prolonged epidemic. Sulphur ointment and benzyl benzoate are the treatments recommended [**30** 145]. Controversy on the necessity of finding the mites to diagnose the disease and of removing them after treatment to ascertain whether they are dead is discussed.

MELLANBY (K.), NORTHEDGE (A. L.) & JOHNSON (C. G.). **Scabies and Intelligence.**—*Lancet* **243** no. 6221 pp. 596–597. London, 1942.

The results of intelligence tests on 250 men suffering from scabies [*Sarcoptes scabiei*, Deg.] indicated that they did not include an abnormally high proportion of men of low-grade intelligence, as is often supposed, though they apparently included rather a low proportion of men of superior intelligence. No significant difference in intelligence was discovered between men who reported themselves sick and others in whom infestation was detected at routine inspections, between those with few mites and those with many, or those with or without secondary infection.

MELLANBY (K.). **Relation between Size of Family and Incidence of Head Lice.**—*Publ. Hlth* **56** no. 3 pp. 31–32, 2 figs., 1 ref. London, 1942.

Analysis of data on infestation by head lice [*Pediculus humanus capitis*, Deg.] among some 3,000 children, chiefly of the poorer families, in an industrial city in north-western England in 1939 shows that the percentage infested rises steadily among both boys and girls as the number of children in the family rises from one to five, though any further increase in the size of the family has little effect on the proportion infested.

MILZER (A.) & LEVINSON (S. O.). **Laboratory Infection with the Virus of Lymphocytic Choriomeningitis. A Two Year Study of Antibody Response.**—*J. Amer. med. Ass.* **120** no. 1 pp. 27–30, 1 chart, refs. 1942. (Abstr. in *Bull. Hyg.* **18** no. 2 pp. 113–114. London, 1943.)

An account is given of a case of lymphocytic choriomeningitis in a man who, six days before the onset of illness, was attempting to transmit the disease from monkey to monkey by means of *Pedicinus* (*Eupedicinus*) *longiceps*, Piag. He noticed several of the lice from a moribund monkey on his hand, and a guineapig into which was injected a suspension of other lice removed from the same infected monkey on the same day died with typical signs of the disease.

TELFORD (H. S.), LONGWELL (J. H.) & MUNRO (J. A.). **Phenothiazine for Cattle Lice Control.**—*Science* **97** no. 2520 p. 354. Lancaster, Pa., 1943.

A dust of equal parts of phenothiazine and white flour proved effective against the sucking lice, *Haematopinus eurysternus*, Nitzsch, and *Linognathus vituli*, L., on cattle in North Dakota, complete mortality being obtained on all the 12 animals tested, but it was ineffective against the biting louse, *Bovicola bovis*, L. The addition to the mixture of an equal amount of sodium fluosilicate gave excellent control of both types of lice.

CARTER (R. H.) & GOODEN (E. L.). **Fluorine Insecticides. A Study of the chemical and physical Properties of commercial Sodium Fluoride and Sodium Fluosilicate in Relation to their insecticidal Use.**—*Soap* **19** no. 3 pp. 99, 101, 117, 3 figs., 5 refs. New York, N.Y., 1943.

As it should be possible to make sodium fluosilicate more economically than sodium fluoride, the results are given of a comparison of some of the physical and chemical properties of commercial samples of the two compounds. It is concluded that most of the commercially available supplies of both are of a satisfactory degree of purity for insecticidal use, but sodium fluosilicate is inferior for dusting because of its relative coarseness and lumpiness. It may be possible to correct these defects in manufacture. The necessity for eliminating physical differences in tests of the relative insecticidal effectiveness of the two compounds is pointed out.

McGOVRAN (E. R.), SCHECHTER (M. S.) & FALES (J. H.). **New Insecticide Material. Study of the Toxicity of Alpha Beta-dibromo-beta-nitroethylbenzene in Oil Sprays against Houseflies.**—*Soap* **19** no. 3 pp. 107, 117, 10 refs. New York, N.Y., 1943.

When tested by the turntable method [*R.A.E.*, B **26** 246], sprays containing alpha, beta-dibromo-beta-nitroethylbenzene at 20 and 10 mg. per ml. in deodorised kerosene gave 81 and 13 per cent. mortality of *Musca domestica*, L., in 24 hours, while sprays containing pyrethrum extract at 2 and 1 mg. pyrethrins per ml. gave 70 and 52 per cent. A spray containing 0·5 mg. pyrethrins and 10 mg. alpha, beta-dibromo-beta-nitroethylbenzene per ml. gave 47 per cent. mortality, but when the amount of the latter in the mixed spray was reduced to 5 mg. per ml., mortality was only 27 per cent. Tests in which mortality counts were made after 48 hours gave essentially the same results. In similar tests, alpha, beta-dibromoethylbenzene (styrene dibromide) at 50 mg. per ml. gave only about the same mortality as 0·5 mg. pyrethrins.

SEN (S. K.). **The Possibilities of Cattle Fly Sprays in India.**—*Indian J. vet. Sci.* **9** pt. 4 pp. 339–348, 2 fldg. graphs, 6 refs. Delhi, 1939. [Recd. 1943.]

The use of repellent sprays to protect cattle from flies is discussed, and an account is given of experiments in the United Provinces in 1936 and 1937 on

the effect on milk yield of spraying against *Lyperosia exigua*, de Meij., and *Musca crassirostris*, Stein. The two sprays tested in the first season were one part of an emulsion of 1 lb. hard soap, 1 gal. water, 4 gals. petroleum and 4 oz. powdered naphthalene diluted in three parts of water, and one part of a proprietary preparation consisting of a pyrethrum extract (Pyrocide 20) and a soap spreader in 15 parts water. Although, after a preliminary unsuccessful trial of application with a flit sprayer, the repellents were smeared on the cattle with cotton wool, they had no marked effect. Three spray mixtures were tested in 1937, and 5 parts by volume Pyrocide 20, 92 parts high speed diesel oil and 3 parts pine oil proved more effective than 1 gal. fish oil, 2 oz. oil of tar, 2 oz. oil of pennyroyal and ½ pint kerosene [*cf. R.A.E.*, B **1** 98] or 300 cc. petrol, ¾ oz. pyrethrum and 75 cc. pine oil [*cf.* **24** 304–305]. It was repellent to *L. exigua*, *M. crassirostris* and other flies, and when applied daily with a fly sprayer at 6 a.m. for 21 days from 2nd October at the rate of 60 cc. per cow increased the milk yield of four cows by an average of 1·6 lb. per day, the average increase for individual cows ranging from 0·6 to 3·1 lb. It caused no scorching or scurfing. The average daily yield during the three weeks after spraying was discontinued was still appreciably higher than that during the period before treatment, while the yield from four control cows was practically constant throughout the nine weeks. It is thought that half the amount applied would provide adequate coverage and be effective for 10 hours, but the cost would still be too high to make spraying a part of regular dairy practice in India.

Soni (B. N.). **Damage to Hides caused by Cattle Ticks in India.**—*Indian J. vet. Sci.* **9** pt. 4 pp. 361–365, 1 col. pl., 2 refs. Delhi, 1939. [Recd. 1943.]

Attention is drawn to the very great damage caused to hides and skins as a result of infestation by ticks, which greatly reduces their value and often renders them completely unfit for sale. The appearance of hides from infested animals is briefly described, and a tanner's report on six pieces of ox hide from the front, back and lumbar region of an animal from Mukteswar that had been infested with larvae of two common cattle ticks 30 days before it was killed is quoted. It shows that all the tanned pieces were pitted with tick marks, and the pits were still visible as " spotting " on the finished leather.

Soni (B. N.). **Studies on the Morphology of the larval Forms of *Hypoderma crossii* Patton.**—*Indian J. vet. Sci.* **9** pt. 4 pp. 367–369, 1 pl., 2 refs. Delhi, 1939. [Recd. 1943.]

The young and full-grown larvae of *Hypoderma crossi*, Patt., are described from specimens collected on goats in the Punjab and the North-West Frontier Province [*cf. R.A.E.*, B **29** 54], and characters are given distinguishing the full-grown larva from that of *H. lineatum*, Vill.

Soni (B. N.). **Further Observations on the Bionomics of the Ox Warble-fly (*Hypoderma lineatum* de Villers) in India.**—*Indian J. vet. Sci.* **9** pt. 4 pp. 431–435, 1 pl., 1 fig., 6 refs. Delhi, 1939. [Recd. 1943.]

Continued observations on the bionomics of *Hypoderma lineatum*, Vill., on cattle in Mukteswar [*cf. R.A.E.*, B **27** 147] and other parts of India showed that in order to plan a campaign for its control, calendars of its seasonal occurrence in the different infested localities must be drawn up, as this varies considerably from place to place. The calendar for Mukteswar is given. The occurrence of young larvae is recorded from the oesophagus, trachea, aorta, pleural membrane, diaphragm, rumen, intercostal muscles, muscular tissues of the vertebral column and neural canal. In many cases, young larvae in the oesophagus caused haemorrhage and stenosis of the gullet wall and their alimentary tracts contained traces of blood clots. Penultimate-stage larvae

from the subcutaneous tissues of the back also showed evidence of having ingested blood. Pockets of pus round larvae in the hypodermic stage resulted in the spoiling of considerable quantities of meat. The oesophageal forms of *H. lineatum* were observed in goats at Mukteswar [*cf.* **12** 62], and mature larvae under the subcutaneous tissues of the backs of sheep in the Salt Range area of the Punjab.

HAMMER (O.). **Biological and ecological Investigations on Flies associated with pasturing Cattle and their Excrement.**—*Vidensk. Medd. Dansk. naturh. Foren.* **105** repr. 257 pp., 50 figs., 7½ pp. refs. (With a Summary in Danish.) Copenhagen, B. Lunos, 1941. [Recd. 1943.]

The investigation that forms the subject of this monograph was made with a view to devising means of controlling the Muscids that molest cattle in the field in Denmark. As it was soon observed that they were breeding in cow droppings in the field, the study was confined to the Diptera of various families breeding in this medium. Previous literature on the subject is briefly reviewed. The work is based exclusively on field observations, made in several localities, mostly near Copenhagen. The methods, localities and climatic conditions, and the nature and temperature of the breeding medium are described. A list is given of 64 of the species of Diptera caught on cows and taken in droppings, and their distribution in Europe is briefly reviewed; at least 28 occur in all parts of Denmark in which cows pasture. Subsequent chapters deal with the feeding habits of adults, pairing, oviposition, the habits of larvae and sites of pupation, duration of development, daily period of activity of adults in relation to meteorological conditions and the activity of the cows, seasonal occurrence, hibernation and factors that exercise natural control. There is a very brief chapter on artificial control dealing chiefly with *Lyperosia irritans*, L., the most injurious species, 250–500 individuals of which may be found on a cow at one time, and two or three times as many on a bull. Its numbers are reduced if the cattle are not kept in the field by night, apparently because of the concentration of predators in the smaller volume of droppings in the field. The recommended procedure is to spray the flies on the cattle in the sheds once or twice daily for two or three days at the peak periods of the successive generations, which occur at intervals of about 18 days throughout most of the summer. Other blood-sucking species taken were *Haematobia stimulans*, Mg., and *Stomoxys calcitrans*, L., and the facultative blood-suckers included *Musca autumnalis*, Deg., *M. tempestiva*, Fall., and species of *Morellia* and *Hydrotaea*, which attack wounds or the secretions from the eyes and nostrils and the saliva.

PAVLOV (P.). **Das Vorkommen von Theileriose in Mazedonien.** [The Occurrence of Theileriasis in Macedonia.]—*Dtsch. tierärztl. Wschr.* **50** no. 43–44 pp. 458–460, 2 figs., 28 refs. Hanover, 1942.

In April–May 1942, 16 cases of piroplasmosis caused by *Theileria* occurred in cattle at a village in south-eastern Jugoslavia, 12 of the animals dying in 3–5 days. The only tick found on the infected animals and on others in the district was a species of *Hyalomma* (here called *aegyptium*, L. [but *cf. R.A.E.*, B **24** 196]), and both nymphs and adults were present. Usually there were 5–12 ticks on an animal, some being fully engorged. As the tick appears chiefly in spring, it is probable that the disease occurs in Macedonia only from March to June.

ALBISTON (H. E.). **Spirochaetosis or Tick Fever of Poultry.**—*J. Dep. Agric. Vict.* **41** pt. 1 pp. 11–14, 4 figs. Melbourne, 1943.

Notes are given on the morphology, bionomics and control of *Argas persicus*, Oken, and *Dermanyssus gallinae*, Deg. (*avium*, Dugès), both of which occur on

fowls in Victoria and are vectors of spirochaetosis of poultry [*Spirochaeta anserina*], the symptoms of which are described. The tick is a serious pest only in the warmer parts of the State and the disease was formerly thought to be confined to the north, where it is practically endemic, particularly near the River Murray, but outbreaks of the latter have been recorded from the neighbourhood of Melbourne during the past few years.

Howell (D. E.), Stiles (G. W.) & Moe (L. H.). **The Fowl Tick** (*Argas persicus*), **a new Vector of Anaplasmosis.**—*Amer. J. vet. Res.* **4** no. 10 pp. 73–75, 1 ref. Chicago, Ill., 1943.

The only Argasid tick that had been shown to transmit anaplasmosis before these experiments were made was *Ornithodoros lahorensis*, Neum. [*R.A.E.*, B **23** 91; **25** 3]; Boyton, Herms and Howell (unpublished data) failed to obtain transmission by *O. coriaceus*, Koch, and *O.* (*Otobius*) *megnini*, Dugès. In view of inquiries from the south-western United States on the part played by *O. megnini* and *Argas persicus*, Oken, in spreading the disease in cattle, the authors investigated the ability of these species to effect stage to stage transmission, and that of the former, a one-host tick, to effect hereditary, and the latter mechanical, transmission. The material and methods used are described. One cow on which 38 individuals of *A. persicus* spent two days and fed a fortnight after being left for two days on an infective animal developed the disease in a severe form after an interval of 61 days. The results of the other experiments were negative. *A. persicus* normally feeds on fowls, but ticks of this species, stated to have been taken on cattle, were three times received by one of the authors for identification and they feed readily on cattle under experimental conditions.

Cooley (R. A.) & Kohls (G. M.). *Antricola* **new Genus,** *Amblyomma gertschi* **new Species, and Notes on** *Ixodes spinipalpis* (**Acarina: Ixodoidea**).—*Publ. Hlth Rep.* **57** no. 46 pp. 1733–1736, 1 pl., 1 fig. Washington, D.C., 1942.

Antricola, gen. n., is erected for *Ornithodoros coprophilus*, McIntosh, the genotype, and *O. marginatus*, Banks, both of which are known only from bats or bat retreats. The male of *Amblyomma gertschi*, sp. n., is described from a three-toed sloth [*Bradypus*] in the Panama Canal Zone. The authors consider that *Ixodes dentatus* var. *spinipalpis*, Nutt. [*R.A.E.*, B **4** 55] is a distinct species. They have seen specimens from the type locality in western Canada and have others from various rodents in Washington, Oregon, California, Idaho and Montana. These had been erroneously identified as *I. diversifossus*, Neum., a southern form described from a racoon, *Procyon lotor*, in New Mexico; characters distinguishing the two species are given.

Davis (G. E.). **Species Unity or Plurality of the Relapsing Fever Spirochetes.**—*Publ. Amer. Ass. Adv. Sci.* no. 18 pp. 41–47, 12 refs. Washington, D.C., 1942.

The author reviews various criteria that have been used for the differentiation of relapsing-fever spirochaetes, *viz.* staining reactions, cross-immunity tests, protection or neutralisation tests and pathogenicity for different hosts, and shows that none of these is satisfactory. He then discusses the value of the specific relationship between spirochaete and tick for this purpose. In experiments carried out since 1936, with some 1,600 individuals of *Ornithodoros hermsi*, Wheeler, *O. turicata*, Dugès, and *O. parkeri*, Cooley, from various parts of the United States and spirochaetes from each species, no tick transmitted spirochaetes derived from either of the other two species. On the other hand, a species from one locality never failed to transmit the spirochaetes from the

same species from another locality. There was 30–100 per cent. transmission of spirochaetes derived from ticks of the same species. Anomalous results were obtained in 1940 with *O. parkeri* from California and *O. turicata*, which transmitted spirochaetes from each other, although there was an indication that the association between *O. parkeri* and the spirochaete from *O. turicata* [*Spirochaeta turicatae*] was transient. To explain this, an account is given of cross-breeding experiments with these two species, which indicated that a hereditary factor determines the transmission of strains of spirochaetes and that some of the California ticks used in the 1940 experiment were probably hybrids. In these experiments, a virgin female of *O. parkeri* paired with a male of *O. turicata* and seven progeny were reared to the adult stage. One of the females, which engorged in the fourth nymphal stage on a mouse infected with a *parkeri* strain of spirochaetes, transmitted the infection three times when adult. Four females from this series mated with *O. turicata* and gave rise to larvae that failed to transmit spirochaetes. In the nymphal stages, many of these engorged on rats infected with *parkeri* and *turicata* strains of spirochaetes, respectively, and subsequently transmitted these spirochaetes.

O. rudis, Karsch, from South America, *O. erraticus*, Lucas (*marocanus*, Velu) and *O. moubata*, Murr., from Africa and *O. tholozani*, Lab. & Mégn. (*papillipes*, Bir.) from the Russian Union were then used in transmission experiments with strains of spirochaetes from the three North American ticks. *O. rudis* and *O. erraticus* failed to effect transmission, but *O. tholozani* transmitted *turicata* spirochaetes to a guineapig, and *O. turicata* effected 90 per cent. transmission after feeding on the guineapig infected by *O. tholozani*. However, later tests of the same batch of *O. tholozani* on white mice were negative. *O. moubata* transmitted *hermsi* and *parkeri* spirochaetes, but adults that had acquired *hermsi* spirochaetes as nymphs were dwarfed and failed to oviposit after engorgement and mating, while although transmission of *parkeri* spirochaetes was effected up to and including the adult stage, only four females out of 12 oviposited. The progeny were given three successive feedings with negative results. Spirochaetes of the *parkeri* strain were present in the coxal fluid of females that failed to transmit when tested the second time. It is generally accepted that in *O. moubata*, transmission is effected through the coxal fluid.

Injection experiments showed that spirochaetes survived longer in the species of tick from which the strain was derived than in others, in which they were, however, shown to persist for some days. Nicolle & Anderson had demonstrated by injection the persistence of a tick-borne strain of spirochaetes in lice [*R.A.E.*, B **14** 168, 194], but the lice did not effect transmission by feeding.

The nomenclature of spirochaetes is discussed, and it is concluded that the results of the experiments described suggest that each species of *Ornithodoros* that is a vector of relapsing fever carries a spirochaete that is tick host-specific [but *cf.* **17** 62 ; **19** 18 ; **21** 244] and that this relationship offers a more accurate approach to the differentiation of spirochaetes than any of the several criteria used up to the present. The names *Spirochaeta hermsi* and *S. parkeri* are therefore proposed for the spirochaetes carried by *O. hermsi* and *O. parkeri*, respectively.

Davis (G. E.). **Tick Vectors and Life Cycles of Ticks.**—*Publ. Amer. Ass. Adv. Sci.* no. 18 pp. 67–76, 48 refs. Washington, D.C., 1942.

A list is given of the five species of *Ornithodoros* known to transmit relapsing fever to man in the western hemisphere, and the situation in each of the countries of America and the West Indies and each State of the United States from which relapsing fever has been recorded is briefly reviewed from the literature. A general life-history of *Ornithodoros* is outlined, with a brief survey of the species about which little or nothing is known. Lists are given of the 10 American species chiefly parasitic on bats and the 14 parasitic on other mammals

(chiefly rodents), birds or reptiles, showing their distribution, and, where known, the approximate duration of larval feeding, the periodicity of moulting, the number of nymphal stages and the countries or States in which the vectors of relapsing fever transmit the disease. The paper concludes with a discussion of the hosts and habitats of the ticks, their feeding, pairing, and oviposition habits, moulting, hibernation and fertility, and the span of life, number of nymphal stages and duration of the life-cycle.

Cooley (R. A.). **Determination of** *Ornithodoros* **Species.**—*Publ. Amer. Ass. Adv. Sci.* no. 18 pp. 77–84, 46 refs. Washington, D.C., 1942.

As failure to identify species of *Ornithodoros* correctly has been due mainly to failure to recognise the constant characters, these characters are reviewed. The value of host relationships and geographical distribution in species determination is pointed out, and attention is drawn to the possibility of interbreeding of species in nature. Finally, a list is given of the known species of *Ornithodoros* [*sens. str.*], arranged according to the continent in which they occur, and under each are shown its synonyms if any, the reference to the original description, references to any subsequent more adequate descriptions, the more important differentiating characters in nearly all cases, the host or hosts if known and the geographical distribution. *O. anduzei*, Matheson [*R.A.E.*, B **30** 96] is considered a synonym of *O. azteci*, Matheson, which was described in a paper already noticed [**23** 306].

Mazzotti (L.). **Estudio sobre la transmisión de** *Spirochaeta venezuelensis.* [A Study on the Transmission of *S. venezuelensis.*]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 4 pp. 297–301, 12 refs. Mexico, D.F., 1942. (With a Summary in English.)

It has been generally believed that relapsing fever in Panama, Colombia and Venezuela is caused by one species of spirochaete (*Spirochaeta venezuelensis*) and that this spirochaete is transmitted by both *Ornithodoros rudis*, Karsch (*venezuelensis*, Brumpt) and *O. talaje*, Guér. [*cf. R.A.E.*, B **28** 68; **31** 50]. The two species have been confused, however, and though Dunn obtained experimental transmission by *O. talaje* of spirochaetes of unstated origin [**15** 158], its importance as a natural vector of *S. venezuelensis* is doubtful, particularly in view of the suggestion that two species of *Ornithodoros* do not normally transmit a single species of spirochaete [**31** 176].

Individuals of *O. rudis* collected in Colombia by the author in 1941 were shown by feeding experiments to be infected with spirochaetes. As this tick, which apparently does not occur in Mexico, is difficult to maintain in captivity, an attempt was made to preserve the strain of spirochaetes in individuals of *O. talaje* collected in a locality of Mexico in which infected examples had never been found. In four experiments, only one batch of 10 out of 139 individuals of this species that had fed on infected rodents, transmitted the spirochaete to a test animal. An injection experiment showed that the spirochaete could survive in the tick for six months. These results and the fact that *O. rudis* is not known to occur in the United States where Davis found *O. talaje* naturally infected with spirochaetes [**29** 145] are thought to suggest that *S. venezuelensis* is biologically distinct from the spirochaete of which *O. talaje* is the natural vector.

Carr (H. P.) & Hill (R. B.). **A Malaria Survey of Cuba.**—*Amer. J. trop. Med.* **22** no. 6 pp. 587–607, 1 map, 18 refs. Baltimore, Md., 1942.

A malaria survey of Cuba was begun in 1936 and completed in 1942. The island and its population and climate are described, and data are given on

malaria morbidity and mortality. The methods used in the survey are explained, and the results in the six provinces shown in detail in a series of tables and discussed. Those in four of them have already been noticed [*R.A.E.*, B **28** 121 ; **30** 106, 132]. Spleen rates were, on the whole, low, the highest being in Camagüey Province, where 16 per cent. of the children examined had palpable spleens [*cf.* **30** 106]. Only 201 children out of 42,320 examined had parasites, the percentage of positive blood samples increasing with the size of the spleen. Malaria is not endemic in a large part of the island, and only mildly to moderately so in limited areas in the remaining part. Endemicity is practically limited to areas near the coast or flat alluvial valleys composed of dense impervious clay [*cf.* **28** 121 ; **30** 133], and the porous character of the soil in large sections of the country is not favourable to Anopheline breeding. Yearly epidemics occur in localised areas, and widespread ones at long intervals. Much of this epidemic malaria is man-made [**30** 106].

Five species of *Anopheles* were found during collection of larvae and adults. *A. albimanus*, Wied., the most prevalent species, comprised over 95 per cent. of the larvae collected and is considered to be the principal vector of malaria. It breeds in the fresh water portions of mangrove swamps, in low-lying areas near the shore where water collects, in rain-water in coral rocks, in the alluvial valleys, in sluggish streams with horizontal vegetation, in lakes and ponds and in brick and borrow pits. It avoids situations that are more than slightly shaded. It was usually in the minority in survey captures of adults in four provinces, but the figures are not considered representative. In routine daily captures made in one locality in Havana Province for three years and in two cities in Oriente Province for two years in connection with drainage works, it represented over 98 and 99 per cent. of the catch, respectively. The numbers taken in all three places were influenced by the control measures, and heavy rain was always reflected in increased catches. *A. crucians*, Wied., and *A. vestitipennis*, D. & K., comprised most of the catch in a special survey in marshy, coastal areas of Pinar del Rio Province. In a host preference experiment in which two traps were operated side by side, one baited with a man and the other with a calf, 45, 28 and 76 per cent. of the adults of *A. albimanus*, *A. crucians* and *A. vestitipennis*, respectively, were attracted to man. All of the 3,800 Anophelines examined for malaria parasites were negative except for one female of *A. crucians* with a heavy sporozoite infection. This species probably transmits malaria in certain areas near the coast. Experimental infection developed in 85 out of 355 females of *A. albimanus*. Attempts to infect 43 of *A. crucians* and 44 of *A. grabhami*, Theo., failed, but one of 12 of *A. vestitipennis* fed on a good carrier showed a fair number of medium-size oöcysts 20 days after infection. This is slower development than would normally be expected, but the possibility that this species may be an occasional vector cannot be ignored [*cf.* **30** 23]. *A. atropos*, D. & K. [**28** 121 ; **30** 133], which was recorded from Cuba for the first time, and *A. grabhami* are not implicated in malaria transmission.

Wood (S. F.). **The Persistence of *Trypanosoma cruzi* in dead Cone-nosed Bugs (Hemiptera, Reduviidae).**—*Amer. J. trop. Med.* **22** no. 6 pp. 613–618, 1 pl., 8 refs. Baltimore, Md., 1942.

As immobile and moving crithidias or trypanosomes were often observed in the faeces of bugs of the genus *Triatoma* that were infected with *Trypanosoma cruzi* and had died naturally in the laboratory either as nymphs or adults, and mice were infected by means of faeces from dead bugs, studies were made to determine how long the flagellates could be detected in bugs that had been killed by exposure for 5–10 minutes to a temperature of 117–120°F. in a moist chamber, after a long period of infection. Crithidias or trypanosomes, usually immobile, were detected in the faeces of all but 21 of 270 bugs examined 0–15

days after they had been killed, including the majority of those examined on all days except the last, on which two out of four were infected. This shows that it is possible to diagnose *T. cruzi* in dead Triatomids as much as 15 days after death.

Records are also given of the finding of active and immobile crithidias and trypanosomes in the body fluids of four examples of *Triatoma rubida*, Uhl., and three of *T. protracta*, Uhl., all of which were dead. In two cases, the invasion of the body fluid was probably due to injury by pressure, but in another it was not, and it is thought that some of the insects died of the infection. Bugs with body-cavity infections might, on account of weakness, be less likely to leave rodent burrows than healthy ones. Both rats and mice eat bugs readily in the laboratory and probably do so in nature. Rodents consuming bugs of which the body fluid was infected would probably acquire the infection, as these bugs were always found to harbour the metacyclic (infective) forms. A mouse that bit a dead nymph with infected fluid showed no trypanosomes when its blood was examined from 10 to 30 days later, but nine nymphs of *T. protracta* that fed on it on the 16th day had trypanosomes in their faeces 118 days later, thus showing it to be infected. Infection of the body fluids might result in infection of the salivary glands and explain the cases of transmission by biting reported in the literature [*R.A.E.*, B **4** 38; **27** 42].

MAZZA (S.) & CHACON (R. V.). **Primeros animales domésticos y seres humanos con** *Schizotrypanum cruzi* **comprobados en Bolivia.** [First Records of domestic Animals and Man infected with *Trypanosoma cruzi* in Bolivia.]—*Prensa méd. argent.* **30** no. 9 repr. 8 pp., 2 figs. Buenos Aires, 1943.

The authors refer to previous records of infection of Triatomids with *Trypanosoma* (*Schizotrypanum*) *cruzi* in Bolivia [*cf. R.A.E.*, B **31** 111] and state that infection was found in 22 per cent. of the adults of *Triatoma infestans*, Klug, in a town at an altitude of about 10,000 ft. in the Department of Potosi, but not in the nymphs. In the environs of the town, 4 of 16 adult bugs and 1 of 8 nymphs proved to be infected, and infection was also found in a baby and a puppy.

GASIC (G.) & BERTÍN (V.). **Epidemiologia de la enfermedad de Chagas en Chile.** [The Epidemiology of Chagas' Disease in Chile.]—*Rev. chil. Hig. Med. prev.* **3** no. 1 pp. 5–30, 2 pls., 171 refs. Santiago, Chile, 1940. [Recd. 1943.]

The authors review existing knowledge of the manner in which *Trypanosoma cruzi*, the causal agent of Chagas' disease, is transmitted to man, give a list of animals that serve as its natural hosts, and describe the results of investigations on the epidemiology of the disease in Chile. The Triatomids in which the trypanosome has been found there are *Triatoma infestans*, Klug, and *Mepraia* (*T.*) *spinolai*, Porter [*cf. R.A.E.*, B **30** 14]. Both are widely distributed, but the latter is not a domestic species and occurs among rocks and stones in the open. *T. infestans* is numerous in houses in the Provinces of Atacama and Coquimbo, in the north, and only slightly less so in those of Santiago and Aconcagua, in the centre. Its southern limit of distribution in Chile is not known. It prefers a warm dry habitat, such as is afforded by native mud dwellings, with numerous cracks in the walls, and is repelled by light, damp and cold. In investigations from June 1937 to December 1939, the results of which are shown in a table, 7,217 examples of this Triatomid were collected from these four Provinces. The percentage infected averaged 40 and rose to 59 in one district in Coquimbo, where infected bugs were taken in 84 per cent. of the infested houses. Of the 27 cases of the disease recorded, 23 occurred in a locality in Atacama where 48 per cent. of the bugs were infected and infected bugs occurred in 82

per cent. of the infested houses. There was some indication that a greater proportion of bugs was infected in summer than in winter. Relatively high percentages of dogs and cats were found infected in various localities.

Pifano (F.). **La enfermedad de Chagas en el estado Yaracuy, Venezuela.** [Chagas' Disease in the State of Yaracuy, Venezuela.]—*Gac. méd. Caracas* **48** nos. 3–7 pp. 201–206, 209–216, 220–227, 232–236, 244–246, refs. Caracas, 1941. [Recd. 1943.]

Chagas' disease was first recorded from Venezuela in 1919 [*R.A.E.*, B **8** 16] and many cases have since been observed there. The investigations described in this paper were carried out in the State of Yaracuy, chiefly in the district known as the Yaracuy Valley. Details are given of 19 acute cases and of the results of xenodiagnosis, using *Rhodnius prolixus*, Stål, which showed that *Trypanosoma* (*Schizotrypanum*) *cruzi* was harboured by 14 of 40 persons who had lived for ten years in dwellings heavily infested by Triatomids. The Triatomids taken by the author were *R. prolixus*, *Triatoma* (*Eutriatoma*) *maculata*, Erichs., *T.* (*E.*) *nigromaculata*, Stål, *Psammolestes arthuri*, Pinto, *Panstrongylus geniculatus*, Latr., *P. rufotuberculatus*, Champ., and a species of *Eratyrus* provisionally identified as *cuspidatus*, Stål. *R. prolixus* is the most important vector; it occurs throughout the State in cracks and interstices in native dwellings, and 63·46–95·52 per cent. of the nymphs and adults were found infected in all the localities investigated. *T. maculata* generally occurs in fowl and pigeon houses, but one batch, including infected nymphs and adults, was taken in a dwelling. *T. nigromaculata* [*cf.* **28** 134] was found naturally infected in a house at a high altitude [**28** 172] and was also taken in fowl houses and tree holes. Two of 52 examples of *Psammolestes arthuri*, which occurs in birds' nests [*cf.* **28** 58], were found naturally infected in 1939. *Panstrongylus geniculatus*, usually found in the burrows of armadillos, was taken in dwellings, and all the individuals examined harboured the trypanosome.

The author also found natural infection in dogs, cats, armadillos, opossums, rodents and bats, and gives details of various strains obtained from these hosts.

Roy (D. N.), Ghosh (S. M.) & Chopra (R. N.). **The Mode of Action of Pyrethrum on the Cockroach,** *Periplaneta americana* **L.**—*Ann. appl. Biol.* **30** no. 1 pp. 42–47, 7 refs. London, 1943.

The following is the authors' summary of this account of experiments on the mode of action of pyrethrum on *Periplaneta americana*, L. Pyrethrin, the active principle, is insoluble in water, but is soluble in the body fluid of the cockroach. It has a selective action on nerve ganglia, and the destruction of their cells is responsible for the death of the insect. Whereas pyrethrum, when used either in the powdered form or in a fluid state mixed with kerosene and introduced directly into the body cavity, reaches the ganglion with the circulation, its mode of action when it acts through the spiracles is different. Kerosene-pyrethrum mixture when introduced into the tracheal trunks through the spiracles is quickly diffused into the haemocoele. When the dry powder is inserted into the trachea, its mode of action is analogous to that of a fluid preparation. As the conversion of pyrethrum from a dry into a fluid state is possible only in the interior of the trachea, the natural conclusion is that a fluid analogous to the body fluid is present in the same situation. As soon as the pyrethrin is dissolved, it is quickly diffused into the haemocoele and thus reaches the nearest ganglion.

Lloyd (Ll.). **Materials for a Study in Animal Competition. The Fauna of the Sewage Bacteria Beds. Part II.**—*Ann. appl. Biol.* **30** no. 1 pp. 47–60, 13 refs. London, 1943.

The following is based on the author's summary. The fluctuations in the relative numbers of various species of flies emerging from sewage bacteria beds

at Knostrop, Leeds, over a period of nearly eight years [*cf.* *R.A.E.*, B **28** 150, etc.] were found to depend on the influences of weather on *Metriocnemus longitarsus*, Goet., and the Enchytraeid worm, *Lumbricillus lineatus*, which dominate the upper layer of the bed, the former being potentially predacious. There is a major flight of *M. longitarsus* in May, a barrage of larvae is formed in June if the weather is cold and wet, and great numbers of eggs laid by other species are devoured [*cf.* **28** 151]. The barrage is thinned or dispersed by hot, dry weather in June. *M. hirticollis*, Staeg., has its major flight about a month later than *M. longitarsus* and so depends for summer establishment on the scarcity or dispersal of larvae of the latter. *Spaniotoma minima*, Mg., is similarly affected, but as its life-cycle is short, it can recover in the cooler months, whereas the thermal requirements of *M. hirticollis* do not allow of this except in a very mild winter. Reduction in the numbers of larvae of *S. minima* (and to some extent possibly of *M. hirticollis*) as a result of the abundance of larvae of *M. longitarsus* reduces the proportion of potential predators in the depths of the bed, and *Psychoda alternata*, Say, and *P. severini*, Tonn., are therefore able to extend their seasons of abundance.

The population of *S. minima* and *M. hirticollis* in autumn largely determines the numbers emerging in the early part of the following year, but the other species are markedly influenced by conditions in winter. *P. alternata* tends to be more abundant after a warm winter, but there is evidence that great density of Chironomid larvae may reduce it then as it does later in the year. Conversely, *M. longitarsus* and *P. severini* tend to be less abundant after a warm winter, although they are essentially winter-breeding species. This is attributed to competition by *L. lineatus*, the life-cycle of which is greatly accelerated by warmth in winter, its principal breeding season. Cold drives it away from the surface, where it almost completely destroys the *Phormidium* in spring. This suggests that the time of sloughing will be earlier or later in spring according to the winter bed temperature, and the period of deprivation for the Dipterous larvae correspondingly hastened or retarded. The prosperity of flies breeding briskly in winter or early spring would be influenced accordingly.

GIBBINS (E. G.). **On the Habits and Breeding-places of** *Aëdes* (*Stegomyia*) *simpsoni* **Theobald in Uganda.**—*Ann. trop. Med. Parasit.* **36** no. 4 pp. 151–160, 2 figs., 3 refs. Liverpool, 1942.

A study of the habits and breeding-places of *Aëdes simpsoni*, Theo., in Uganda, where it has recently been found to be a vector of yellow fever [*R.A.E.*, B **31** 61], was undertaken during the latter months of 1941 in three widely different areas. Immature stages were found in plant-axils only. The five kinds of plants principally concerned were young trees of a group of closely related varieties of plantain, *Colocasia* spp., pineapple, *Sansevieria* spp. and *Dracaena ugandensis*. The first three, which are grown for food, were the most important. The greatest concentrations of *Colocasia* and the plantains, the highest percentage of these plants harbouring larvae of *A. simpsoni* and the greatest number of larvae per plant were found in the area where yellow fever was endemic [*loc. cit.*]. The latex that is exuded into the water in the axils of certain plants killed larvae of *A. simpsoni*, if the concentration was high, and larvae of *Eretmapodites dracaenae*, Edw., were found to prey upon them.

The adults of *A. simpsoni* bite during the daytime, principally in the forenoon and late afternoon on humid days. They were abundant in native gardens in the immediate environment of their breeding places, but could not be found in dwellings, open buildings or vehicles, and hardly ever crossed even a narrow clearing. The risk of their conveying yellow fever from one region to another is therefore much less than it would otherwise be.

Cannon (D. A.). **Linguatulid Infestation of Man.**—*Ann. trop. Med. Parasit.* **36** no. 4 pp. 160–167, 2 pls., 36 refs. Liverpool, 1942.

An account is given of a fatal case of sub-acute intestinal obstruction in an African woman in Nigeria caused by extremely heavy infestation of the colon by encysted nymphs of the Linguatulid, *Armillifer armillatus*, Wyman. It was not ascertained whether the parasites had a toxic action or whether their effect was purely mechanical. Notes are given on the morphology and systematic position of the Linguatulids, and on the hosts and distribution of the five species that may parasitise man, references in the literature to infestations in man are reviewed, and the pathogenicity of these infestations is discussed.

Burtt (E.). **Observations on the high Proportion of Polymorphic Trypanosome Infections found in the Salivary Glands of** *Glossina brevipalpis* **near Amani, Tanganyika Territory, with a Note on the Appearance of the infected Glands.**—*Ann. trop. Med. Parasit.* **36** no. 4 pp. 170–176, 13 refs. Liverpool, 1942.

Between 15th May and 25th November 1937, 12,550 males of *Glossina brevipalpis*, Newst., from three localities near Amani, Tanganyika Territory, were dissected by a method adapted from one already noticed [*R.A.E.*, B **24** 248], and 105, or 0·84 per cent., were found to have trypanosomes in the salivary glands. The trypanosome was probably *Trypanosoma brucei*, but its identity was not definitely established. The percentage of infections in one of the localities (1·04) is one of the highest recorded in nature. This locality had a lower altitude and therefore presumably a higher temperature than the others, but the highest rate of infection was found during September, when temperatures were almost the lowest of the season. The increase may be related to a low emergence of young flies or to some change in the animal hosts. In 43 of the flies with infected salivary glands, there were also trypanosome colonies in the labrum. The proportion of infected flies was found to vary markedly over short periods and distances. The infected glands appeared chalky white by reflected light and could be recognised with the naked eye. All except three of the 105 infections were heavy.

Davey (T. H.). **The Larva of** *Anopheles flavicosta* **Edwards.**—*Ann. trop. Med. Parasit.* **36** no. 4 pp. 179–181, 7 figs. Liverpool, 1942.

Occasional mosquitos collected at Port Loko, some 30 miles from Freetown in the Protectorate of Sierra Leone, were identified by the late F. W. Edwards as his *Anopheles flavicosta*, and a few adults from Kabala in the hills of the Northern Province as either *A. flavicosta* or a local variant of *A. moucheti*, Evans. Larvae from Kabala, which could not readily be identified, gave rise to adults indistinguishable from those collected in the same place. An adult of *A. flavicosta* was bred from a larvae found near Port Loko, and comparison of the larval pelt and a similar larva with material from Kabala showed that the species there was *A. flavicosta* also. A description of the larva is given, based on the examination of one pelt and one larva from Port Loko and five pelts and two larvae from Kabala. The breeding place at Port Loko was the edge of a stream shaded by grass and trees with a moderate flow and surface vegetation, and that in Kabala was a slow-running, shaded stream in a rice-field containing algae and much surface and submerged vegetation. Larvae were collected from January to August (during the dry season and early rains).

Blacklock (D. B.) & Wilson (C.). **A late seasonal Increase of *Anopheles funestus* in Village Houses.**—*Ann. trop. Med. Parasit.* **36** no. 4 pp. 182–186, 1 pl., 1 ref. Liverpool, 1942. **Simple anti-Malaria Methods for Use in Villages.**—*T. c.* pp. 187–191, 3 pls.

Observations on the numbers of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, in houses in a village in Sierra Leone, made in 1940–41 and recorded in the first paper, bore out the conclusion [*R.A.E.*, B **20** 280] that the former is most plentiful in July while the latter does not reach maximum abundance until September. The village is on a slope. The soil forms a thin layer over laterite, which becomes exposed by erosion if vegetation is uprooted ; numerous rock-pools are thus formed. *A. gambiae* breeds in the street drains and earth- and rock-pools. *A. funestus*, however, was found to occur only in small numbers in these, but in considerable abundance in the springs and run-off from them that are formed in the lower part of the village when the rains have caused the ground-water to rise. An attempt was made to control breeding by clearing the streams that arise from the springs and stocking the springs with fish. However, while the springs were freed of *A. funestus* by this procedure, its numbers increased in the water below them. Possible explanations of this are discussed. The impracticability of attempting to carry out permanent measures for the control of *A. funestus* without knowledge of conditions in the wet season is pointed out.

The second paper deals with measures for the control of *A. gambiae* in villages such as the one under consideration, where it is not possible to cut drains owing to the underlying rock, and agricultural practice favours breeding. They include the construction of surface drains of small stones tightly packed with earth and bordered by two rows of large stones, the terracing of uncultivated compounds with stones and a dressing of pebbles and the establishment of terraced filter-beds under the layer of soil in cultivated ones. Without these filter-beds, the soil is too shallow for successful cultivation as it becomes water-logged, and consequently the farmers build it up into mounds, leaving strips of bare rock between, in which numerous breeding-pools develop. The availability and transport of the necessary materials are discussed.

Papers noticed by Title only.

Bhattacharjee (J.). **A Check-list of the Ectoparasites of the domesticated Animals in Burma.**—*Indian J. vet. Sci.* **9** pt. 4 pp. 437–442, 11 refs. Delhi, 1939. [Recd. 1943.]

Waterston (J.). **Fleas as a Menace to Man and Domestic Animals. Their Life-history, Habits and Control.**—*Econ. Ser. Brit. Mus.* (*Nat. Hist.*) no. 3, 5th edn. revd. by K. Jordan, 20 pp., 7 figs., 2 refs. London, 1942. Price 4*d.*

Packchanian (A.). **Reservoir Hosts of Chagas' Disease in the State of Texas. Natural Infection of Nine-banded Armadillo** (*Dasypus novemcinctus texanus*), **House Mice** (*Mus musculus*), **Opossum** (*Didelphis virginiana*), **and Wood Rats** (*Neotoma micropus micropus*), **with** *Trypanosoma cruzi* **in the State of Texas.**—*Amer. J. trop. Med.* **22** no. 6 pp. 623–631, 4 figs., 15 refs. Baltimore, Md., 1942.

Krafchick (B.). **The Mouthparts of Blackflies with special Reference to** *Eusimulium* [*Simulium*] *lascivum* **Twinn.**—*Ann. ent. Soc. Amer.* **35** no. 4 pp. 426–434, 2 pls., 8 refs. Columbus, Ohio, 1943.

Vargas (L.). **El huevo de** *Anopheles barberi* **Coquillet, 1903.** [The Egg of *A. barberi*, Coq.]—*Rev. Inst. Salub. Enferm. trop.* **3** no. 4 pp. 329–331, 1 fig., 4 refs. Mexico, D.F., 1942. (With a Summary in English.)

Ota (R. K.) & Beckman (H.). **A simple Bird Holder for Use in Avian Malaria Studies.**—*Science* **97** no. 2521 p. 384, 1 fig. Lancaster, Pa., 1943.

LEVER (R. J. A. W.). **Mosquitoes in Viti Levu, December 1942 to February 1943.** —*Agric. J. Fiji* **14** no. 1 p. 16. Suva, 1943.

Aëdes aegypti, L., which breeds regularly in houses, and *A. vexans*, Mg., which breeds in ditches, puddles and ponds and bites in houses at night, caused great annoyance in Suva in December 1942 and January 1943. Later in January, the common mosquito in the north-west and north of Viti Levu was found to be *Culex fatigans*, Wied. Collections of larvae made in and near Suva during February consisted principally of *A. aegypti* from tins and drums, *A. scutellaris*, Wlk., from rot holes in trees, tyres, shells and soapstone drains, *A. vexans*, and *C. annulirostris*, Skuse, from drains in soapstone and earth and the latter also from weedy streams, and *C. fatigans* from drains in soapstone and dirty pools. The larvae are preyed on by the Notonectid, *Anisops cleopatra*, Dist., and dragonfly nymphs.

THOMSON (R. C. M.). **The Control of *Anopheles minimus* by "Shade" and related Methods.**—*Indian med. Gaz.* **77** no. 11 pp. 675–676, 5 refs. Calcutta, 1942.

A summary is given of observations carried out in Assam since 1938 [*R.A.E.*, B **29** 68–69] showing that shade prevents *Anopheles minimus*, Theo., from breeding in a stream, not by repelling ovipositing females, which are attracted to shade, nor by killing the larvae, but by causing the grass at the edge to die away and so eliminating the zone of still water among the grass. Similarly, removing the grass from the edges and leaving them exposed to light is an effective temporary measure, since it also is a form of flushing. Removing vegetation from wells does not increase water movement and does not stop breeding if the water is shaded by vertical walls, but it does so in wells with smooth, sloping walls, where it results in the water being fully exposed to light.

REES (D. M.). **The Mosquitoes of Utah.**—*Bull. Univ. Utah* **33** no. 7 99 pp., 16 pls., 1 map, 7 figs., 26 refs. Salt Lake City, Utah, 1943.

This revision of the mosquitos of Utah includes notes on the biology, distribution and importance as a pest of each species. Supplementary sections deal with their breeding habits, the effects of meteorological conditions on them, their dispersal and migration flights, their distribution by man, and the natural factors that combine in their reduction.

COCHRANE (E.). **Notes on *A. argyritarsis* and *A. pseudopunctipennis* in Grenada.** —*Caribb. med. J.* **4** no. 3 pp. 97–100, 1 ref. Trinidad, 1942.

Further instances are given of the occurrence of malaria in western Grenada in association with *Anopheles argyritarsis*, R.-D. [*cf. R.A.E.*, B **31** 139]. In a study of the habits of this species and *A. pseudopunctipennis*, Theo., larvae of both were found in streams, the former more frequently among upright aquatic vegetation and the latter among spreading algae. *A. pseudopunctipennis* was the commoner in warm, still, surface water, but *A. argyritarsis* occurred in it if there was thick grass at the edges, though it was more often found in the side pools and backwaters of slow-running streams, especially in moderate shade. *A. pseudopunctipennis* was numerous in bright sunlight if algal mats were plentiful, but neither species was found in dense shade. In a wide, shallow, rapid and sunlit river with clean-cut banks devoid of vegetation, larvae of *A. argyritarsis* were abundant in a shaded pool formed by large boulders in mid-stream and thickly lined with moss, but could not be found elsewhere. They also occurred in rain pools, earth drains and hoof marks if the water was fairly clear. They leave the surface more rapidly than larvae of *A. pseudopunctipennis* when disturbed and remain submerged longer, so that special care is required

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when dipping for them. Increased velocity and turbidity of streams during the rainy season eliminate all evidence of breeding of both species in the lower reaches of the rivers and creeks.

The few adults of *A. argyritarsis* caught in houses in the evenings had not fed. Rather larger numbers were caught at dawn, but by far the most in the middle of the night. This shows that, unlike *A. aquasalis*, Curry, *A. argyritarsis* leaves shelter as soon as it has fed. None of the 119 females dissected harboured malaria parasites. A donkey trap yielded a few females of *A. pseudopunctipennis* as well as a number of *A. argyritarsis* but the former rarely enter human dwellings and in Grenada seldom bite man, and dissection of 932 caught in stables yielded negative results. *A. argyritarsis* was not represented in catches in stables. Females of *A. pseudopunctipennis* that had taken blood before being trapped rarely lived more than five or six days in the laboratory, while those that had not had a blood-meal lived much longer. The reverse was true of *A. argyritarsis*. Neither species bit readily in captivity unless blood had already been tasted. *A. argyritarsis* was definitely more attracted to man than *A. pseudopunctipennis*.

Hurlbut (H. S.) & Hewitt (R.). **The Transmission of *Plasmodium lophurae*, an Avian Malaria Parasite, by *Anopheles quadrimaculatus*.**—*Publ. Hlth Rep.* **57** no. 50 pp. 1891–1892, 4 refs. Washington, D.C., 1942.

Experimental infection of *Anopheles quadrimaculatus*, Say, with *Plasmodium lophurae* has already been recorded [*R.A.E.*, B **29** 193; **30** 22]. An account is given of experiments in which females of this Anopheline that had fed on infected ducks and been kept at 74–80°F. transmitted *P. lophurae* to three out of four ducklings on which they fed 17–27 days later. Stomach dissection indicated that some 20 per cent. of the mosquitos developed oöcyst infections. In all cases, the number of parasites appearing in the blood of the ducklings was low. The incubation period was 13–23 days and the patent period 5–12 days.

Parker (R. R.). ***Ornithodoros* Ticks as a Medium for the Transportation of Disease Agents.**—*Publ. Hlth Rep.* **57** no. 52 pp. 1963–1966, 6 refs. Washington, D.C., 1942.

The fact that *Ornithodoros turicata*, Dugès, and *O. parkeri*, Cooley, have been shown to harbour for long periods the causal organisms of certain diseases of which they are not known to be natural vectors [*R.A.E.*, B **25** 121; **28** 197; **29** 126; **31** 41] suggested the possibility of using ticks of this genus as media for transporting rickettsiae and viruses over long distances. Accounts are given of the successful importation into the United States of the rickettsia causing Tobia spotted fever in *O. rudis*, Karsch [**31** 42] and the rickettsia causing South African tick-bite fever and the virus causing Russian spring-summer encephalitis in *O. moubata*, Murr. The intervals between the ingesting of the blood of infected animals by the ticks and recovery of the infection from them by injection were 11 and 53 days in the first case, more than 36 in the second and more than 40 in the third. Attempts to convey the encephalitis in *Ixodes persulcatus*, Schulze (its natural vector) and desiccated mouse brain were unsuccessful, although most of the Ixodids arrived alive. There was found to be complete cross-immunity between Tobia and Rocky Mountain spotted fevers. The cross-immunity reactions of South African tick-bite fever with Rocky Mountain, Tobia and Brazilian spotted fevers, Marseilles fever and epidemic and endemic typhus were similar to those of Marseilles fever, with which this disease is closely related if not identical.

[Polovodova (V. P.).] **Половодова (В. П.). Changes in the Oviducts of *Anopheles* with Age and the Technique of the Determination of the physiological Age of Mosquitos.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 387–396, 4 figs. Moscow, 1941. [Recd. 1943.]

Since the proportion of an Anopheline population that transmits malaria increases with the number of times that the females take human blood, it is important for malaria control that the physiological age of a mosquito population should be known. It has been shown by Mer [*cf. R.A.E.*, B **21** 71] that the ampullae of the common oviduct increase in size with each gonotrophic cycle and thus permit an estimate of physiological age, but little is known of the extent of the increase or the way in which it occurs. Further investigations were therefore carried out in Moscow. Mer's method of dissecting out the oviduct, as simplified by Almazova [**24** 95], is satisfactory, provided that the ampullae are not injured and that they are examined while still pulsating and before they have lost their spherical form. The ampullae should be measured while in saline of which the osmotic pressure is close to that of the mosquito haemolymph, and in the intervals between pulsations; the area by which their size is expressed should be calculated from their length and width, and the average of the two ampullae should be taken, unless one is abnormally shortened.

The appearance of the ampullae and of their epithelial cells and the changes that take place in them are described, and it is shown that those of diapausing Anopheline females, newly emerged females and females that have oviposited once or many times can be distinguished by simple inspection. Measurement of the ampullae of 333 females of *Anopheles maculipennis* var. *atroparvus*, van Thiel, from the Northern Caucasus showed that the area averaged 0·010 sq. mm. for newly emerged females, and 0·021, 0·028 and 0·031 sq. mm., respectively, for females that had oviposited once, twice and three times. The greatest increase in size occurred during the first gonotrophic cycle; the later changes were less pronounced and there was considerable overlapping. A table based partly on the literature is given showing the measurements for newly emerged females and those that had oviposited once of *A. m. atroparvus*, *A. m. messeae*, Flni., *A. m. sacharovi*, Favr, *A. superpictus*, Grassi, and *A. claviger*, Mg. (*bifurcatus*, auct.). The statistical treatment of the material is briefly discussed, and it is emphasised that it should all come from a single ecological habitat. Though the number of mosquitos in a population of the same age steadily decreases with each gonotrophic cyle, the rate of infection rises, and inspection of the ampullae is the easiest way of determining the likelihood of malaria transmission by a given population.

[Shipitzina (N. K.).] **Шипицина (Н. К.). The Influence of the Density of the powdery Pellicle on the Filtration of Food by the *Anopheles* Larva.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 396–401, 3 graphs, 3 refs. Moscow, 1941. [Recd. 1943.]

The area of water surface that can be cleared of solid particles by an Anopheline larva in a given time varies with the size of the filter brushes of the labrum, which increases as the larva grows, with the intensity of filtration, which depends on the temperature [*R.A.E.*, B **25** 140] and the physiological condition of the larva [**24** 71], and with the density of the particles [*cf.* **27** 68], since their mutual attraction is great when they are near each other and part of the energy used by the larva to bring the water surface into motion is spent in separating them.

In experiments on the effect of the density of the surface film of particles on the area cleared by filtration, which were carried out at 25°C. [77°F.], fourth-instar larvae of *Anopheles maculipennis*, Mg., were placed in dishes containing water that had been dusted with dry spores of *Lycopodium* of 130–160μ in

diameter at the rate of 0·9–188 spores per sq. mm. The results were estimated from the numbers of spores found in the gut and are therefore only approximate, but they showed that the areas cleared per larva per minute averaged 65, 30 and 9 sq. mm. when there were 0·9–5, 21–30 and 31–40 spores per sq. mm., respectively. When they were applied at 50–60 per sq. mm., the spores formed a continuous film, and under these conditions their mutual attraction is greatest and the area cleared was least (3 sq. mm.). Further increase in density had no effect. The number of spores swallowed per larva rose to 10 per second as their frequency increased to 21–30 per sq. mm., but fell with a further increase and reached a minimum at 50–60 per sq. mm., after which it rose again. It is concluded, therefore, that poison dusts for the control of Anopheline larvae should not be excessively diluted with inert carriers, since the larvae will not then ingest the maximum of poison, and that a dilution of 1 : 20 is sufficient for satisfactory dispersal. The dust should be applied at a rate that will ensure maximum ingestion.

[VINOGRADSKAYA (O. N.).] **Виноградская (О. Н.). The Spiracle Index of** *Anopheles.* [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 401–403, 2 figs., 2 refs. Moscow, 1941. [Recd. 1943.]

Since the size of the spiracles affects the rate of evaporation of water from insects and hence their resistance to dry conditions, measurements were made of the fore spiracles and the thorax of several species of *Anopheles* from different parts of the Russian Union. It is shown that the index obtained by expressing the length of the spiracle as a percentage of the length of the thorax is of greater value than the length of the spiracle alone in distinguishing xerophilous species, which have low indices, from those that favour more humid conditions, which have high ones.

[NIKIFOROVA (A. V.).] **Никифорова (А. В.). Observation on the Range of Penetration of** *Anopheles maculipennis* **and** *A. bifurcatus* **in a controlled Region.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 404–405, 2 figs. Moscow, 1941. [Recd. 1943.]

The observations described were conducted in May–July 1939 in a coastal village in Abkhazia, in which mosquito control was well organised, to find out how far mosquitos would penetrate into the treated area. This area extended as far as a river, beyond which *Anopheles maculipennis*, Mg., and *A. claviger*, Mg. (*bifurcatus*, auct.) bred in springs and swampy meadows. Mosquitos were collected in cattle sheds situated at 12 points in the village. The greatest numbers were taken at the sites close to the river ; *A. claviger* did not penetrate for more than about 770 yards, or *A. maculipennis* for more than 880 yards. Of 700 adults of *A. claviger* and 500 of *A. maculipennis* that were caught, stained and released near their breeding places, 5 and 12, respectively, were eventually recovered in the village, at maximum distances of about 600 and 700 yards. Two stained females of *A. maculipennis* were recovered alive 40 days after they had been released.

[DROZDOVA (O. I.).] **Дроздова (О. И.). The Flight of** *Anopheles* **across the Volga and the Oka.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 406–409, 3 figs. Moscow, 1941. [Recd. 1943.]

In the town of Gor'kiĭ, which is on the high right bank of the Volga just below the point where the Oka flows into it, Anophelines have been numerous in recent years, in spite of the absence of large breeding places and the successful treatment of small ones. Favourable breeding places, with a total water surface of about 2 sq. miles, occurred, however, on the left bank and mosquitos

were abundant in the villages there. To find whether they fly across the river, 1,500 were stained and liberated on the left bank in August 1937 and catches were made in the town during the following fortnight. Two stained females were taken. The Volga is over half a mile wide at that point, and it is not known whether the mosquitos flew across or were transported by the ferry.

In an experiment on the Oka, several miles above Gor'kii, 850 stained Anophelines were released about half a mile from the right bank, which is swampy and densely covered with shrubs, and one was taken later in a village on the opposite bank, the width of the river being about 550 yards. In this case there was no ferry, so that the mosquito must have flown across. The breeding places on the right bank were systematically dusted in 1938, and considerably fewer mosquitos occurred in the villages on the left bank than in 1937.

[Markovich (N. Ya.).] **Маркович (Н. Я.). Observations on the Dispersal of** *Anopheles maculipennis* **in Connection with the physiological State of the Females and the Movement of Man and domestic Animals.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 410–413, 1 graph. Moscow, 1941. [Recd. 1943.]

In the summer of 1940, observations on the behaviour of adults of *Anopheles maculipennis*, Mg., were carried out in the Province of Archangel in villages on the high left bank of the Dvina ; most of the villages were close to the river, some were about a mile from it and a few were 2½–3 miles away. There were very few Anopheline breeding places on that side of the river, but there were many on the islands in the extensive flooded area on the opposite side. Mosquitos were collected every five days in the villages, and the numbers taken varied inversely with the distance from the river, 84·3, 13 and 2·6 per cent. of the total being taken in the three zones. As the mosquitos entered diapause, their numbers in the remote villages increased, the percentages taken in the second and third zones being 25·9 and 5·1 in August and 30 and 15 in September. The overwintered females that left the villages in spring laid their eggs mostly in the nearest water, but in summer, when the population was much greater, all the breeding places contained larvae.

Examination of huts and animal sheds on the islands before they were occupied by haymakers and their horses showed that 54·1 per cent. of the mosquitos in them were newly-emerged females, 36·3 per cent. males, 7 per cent. females that had almost completed blood digestion, and 2·7 per cent. females that contained blood. When the huts were occupied during the hay-making season, which lasted for about three weeks from 17th July, mosquitos were much more numerous and concentrated in the sheds used by the horses. They consisted mostly of females that had taken blood, with a considerable number of unfed ones and a few males. Many females in various stages of blood digestion and males occurred among the vegetation adjoining the sheds. Precipitin tests showed that 217 of the mosquitos taken in sheds occupied by horses and in the surrounding vegetation had fed on horses and only one on man. Very few mosquitos occurred in the workmen's huts unless the horses were kept in the open, but of those taken in the huts, 59–81·5 per cent. contained human blood.

[Dotzenko (A. A.).] **Доценко (А. А.). Malaria Control Measures in the Construction of Ponds.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 413–418, 5 figs. Moscow, 1941. [Recd. 1943.]

This is a discussion of measures that should be adopted in the construction of reservoirs and other impounded waters in the Province of Rostov to render them unsuitable for Anopheline breeding. Many of the recommendations are

similar, with slight modifications to suit local conditions, to those already noticed [*R.A.E.*, B **31** 160, 161]. Since breeding is favoured by aquatic vegetation, it is suggested that this should be uprooted and cleared away by machine once a month, unless the water is used for fish breeding.

[SARIKYAN (S. Ya.) & POLEZHAEV (V. G.).] **Сарикян (С. Я.) и Полежаев (В. Г.). Epidemiological Importance of the Destruction of *Anopheles* Adults in Rooms.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 418–425, 4 graphs. Moscow, 1941. [Recd. 1943.]

The effect on malaria of controlling Anophelines in houses was studied in 1940 in two isolated villages situated close to a large reservoir near Moscow. The reservoir had been completed in 1938, and in 1939 it became covered with aquatic vegetation that provided favourable conditions for the breeding of *Anopheles maculipennis*, Mg. An outbreak of malaria occurred in that year in the two villages, 24·2 and 10·4 per cent. of their inhabitants becoming infected as compared with averages of only 0·9 and 2·6 per cent. in 1933–35.

The mosquitos were collected in inhabited houses every other day and the cow-sheds were sprayed with a 3 per cent. solution of soft soap applied at the rate of 1½ fl. oz. per sq. yd. The age of the females was determined by measuring the ampullae of the oviduct, and the numbers of mosquitos that entered or left the buildings were estimated by means of traps. Owing to the cold spring, the adults of the first generation did not emerge until the second half of June, and the mosquitos were most abundant in the second half of July and August. Examination of the ampullae of mosquitos from the two villages and from a third in which the adults were not destroyed indicated that the percentages of old females were similar at the beginning of the season, but much lower in the treated villages from July onwards. The number of mosquitos trapped when leaving treated cow-sheds was only one-seventh of those taken in an equal number of traps when entering control ones. The parasite index in the two villages decreased from 8·4 and 3·7 per cent. in the spring of 1940 to 1·5 and 1 per cent., respectively, in the autumn, and in both villages together there were only 7 primary cases of malaria in the second half of the year, as compared with 32 during the same period in 1939.

[KAZANTZEV (B. N.).] **Казанцев (Б. Н.). A Design of standard cartographic Symbols for Water Vegetation.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 425–427, 4 figs. Moscow, 1941. [Recd. 1943.]

Since the suitability of water for Anopheline breeding depends largely on the type of vegetation in it, it is suggested that this should be marked on maps to assist the planning of control measures, particularly dusting from aircraft. Symbols are therefore proposed for the commoner aquatic plants of European Russia.

[MIRONOV (V. S.).] **Миронов (В. С.). On Principles of Control of Tick-vectors of Encephalitis.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 427–433. Moscow, 1941. [Recd. 1943.]

In view of the importance of *Ixodes persulcatus*, Schulze, in the transmission of spring-summer encephalitis in the Russian Union [*cf. R.A.E.*, B **31** 70, 71], a survey is made of the measures that should be applied against this tick. They comprise short-term measures, such as examination of the body and clothes for the presence of ticks, impregnation of the clothes with repellents, and the use of overalls closely fitting at the neck and wrists, and long-term measures designed to eliminate the ticks by rendering ecological conditions unsuitable for them. These include the treatment of infested cattle, the destruction of

hares and other wild animals that serve as hosts for the larvae and nymphs, and reducing humidity and increasing fluctuations in temperature by destroying the moss cover in pastures, clearing forests, and planting the less leafy trees. These measures act slowly, but are durable in their effect, and should be applied in accordance with local conditions.

[Pospelova-Shtrom (M. V.).] **Поспелова-Штром (М. В.). On the Technique of Feeding Ixodidae in the Laboratory.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 433–436, 1 fig., 5 refs. Moscow, 1941. [Recd. 1943.]

[Olsuf'ev (N. G.).] **Олсуфьев (Н. Г.). On the Technique of Breeding Ixodidae in the Laboratory.** [*In Russian.*]—*T. c.* pp. 436–439, 9 figs., 1 ref.

In the first paper, the author describes a collar made of tin, cardboard or celluloid film to be worn by laboratory animals when ticks are fed on them. The collars prevent the animals from dislodging the ticks. Rabbits were suitable hosts for 21 species, a list of which is given. To avoid the risk of the ticks escaping, the cage containing the host was placed in a basin the edge of which was coated with an adhesive.

The second paper contains an account of the method used by the author for breeding ticks in the laboratory. The ticks are kept in upright test tubes with cotton-wool stoppers. The bottom quarter of each tube is filled with dry pine sawdust and the rest contains a strip of crinkled filter paper. The lower layers of the sawdust are moistened monthly with sterile water by inserting a pipette to the bottom of the tube. If it is desired to retard the development of the ticks, the tubes are placed in a refrigerator and the sawdust moistened once in two months ; fed and unfed larvae and nymphs of *Ixodes ricinus*, L., and adults of *Dermacentor pictus*, Hermann, survived in the tubes for up to two years at 4°C. [39·2°F.]. Engorged females were kept singly, but up to 100 engorged larvae or 50 nymphs could be kept in one tube.

Engorged larvae and nymphs are often eaten by their hosts, particularly by mice. To protect them and facilitate their collection when they dropped from the host, the latter was placed in a cylinder with perforations through which they fell into a container.

[Khelevin (N. V.).] **Хелезин (Н. В.). The Hibernation Shelters of** ***Anopheles*** **in the Ivanovo Region.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 440–444. Moscow, 1941. [Recd. 1943.]

Investigations in villages in the province of Ivanovo (central Russia) from September 1936 to the end of May 1937 showed that females of *Anopheles maculipennis*, Mg., overwintered chiefly in warm and semi-warm shelters, such as the basements of inhabited houses and the underground stores in which vegetables are kept, probably because of the suitable humidity in them (73–96 per cent.) and the comparatively even temperature (2–6°C. [35·6–42·8°F.] in the semi-warm shelters and 8–10°C. [46·4–50°F.] in the warm basements). The mosquitos seldom congregated in cold quarters, such as unoccupied houses. On the whole, they preferred low, dark and badly ventilated buildings and were almost entirely absent from attics. Hibernating mosquitos also occurred in cow-sheds, but they did not contain blood and so were apparently attracted by the microclimate and not by the presence of animals. The percentage mortality between November and April averaged 96·8 in basements with a relatively high constant temperature and humidity, probably because the fat-body was prematurely exhausted, 35·7 in cold quarters, probably as a result of sharp fluctuations in temperature and humidity, and only 8 in the semi-warm shelters, such as the vegetable stores, and in animal quarters. In the warm basements, some hibernating mosquitos were destroyed by spiders, of which *Tegenaria derhami*, Scop., was common and also occurred in vegetable stores.

[TARABUKHIN (I. A.).] **Тарабухин (И. А.). The Distribution of the Subspecies of *Anopheles maculipennis* in the Novosibirsk Region.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 444–450. Moscow, 1941. [Recd. 1943.]

Of 3,011 batches of eggs of *Anopheles maculipennis*, Mg., collected from breeding places or laid by females taken in day-time resting places in various parts of the province of Novosibirsk, 79·3 per cent. belonged to var. *messeae*, Flni., and the rest to var. *typicus*. The local distribution and relative abundance of these varieties are discussed and shown in a table. Var. *messeae* predominated in the basin of the Ob, in the south and north of which malaria is endemic, was the only variety in the Barabinsk steppe, where malaria is also endemic, though its incidence is low, and constituted 69·1 per cent. of the population in the Kuznetzk and Shor areas, though var. *typicus* occurred alone in southern Shor. Malaria is endemic in the north of this region and epidemic in the south.

In both varieties the eggs resembled those described by Missiroli, Hackett & Martini [*R.A.E.*, B **21** 177], but variations in the character of the surface were frequent, even in eggs of the same batch, and the peculiarities in the markings and structure are briefly described. The number of eggs in a batch ranged from 5 to 385, with an average of 149, for *messeae*, and from 36 to 369, with an average of 210, for *typicus*. The average measurements of the eggs from different zones of the Province are shown in a table ; the eggs and floats of *typicus* were larger than those of *messeae*, and there were more ribs in the floats.

[PORYADIN (S. I.).] **Порядин (С. И.). On the northern Limit of the Spreading of *Anopheles hyrcanus* Pall.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 p. 451. Moscow, 1941. [Recd. 1943.]

In a survey of the left bank of the lower Volga in September 1940, *Anopheles hyrcanus*, Pall., was not found north of a point situated at 46° 33′ N. lat., where a single female was taken. Further south in the delta, the adults were abundant among the reeds and shrubs, and readily attacked man in the evening. None occurred in dwellings or tree holes, and no larvae were found, probably because it was late in the season.

[YAROVAYA (A. M.).] **Яровая (А. М.). The Species of *Anopheles* and the Subspecies of *Anopheles maculipennis* in the Poltava Region.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 451–453. Moscow, 1941. [Recd. 1943.]

Observations in 1938–40 in the province of Poltava showed that *Anopheles maculipennis*, Mg., was represented by var. *messeae*, Flni., which predominated in all districts, var. *typicus* and var. *atroparvus*, van Thiel, which was the least common. Notes are given on their local distribution, abundance and seasonal occurrence. The adults were common in inhabited houses, stables, pig-sties and particularly cow-sheds, but were absent from wooden latrines in July and August because they became overheated. The other Anophelines found were *A. plumbeus*, Steph., which was rare, and *A. claviger*, Mg. (*bifurcatus*, auct.), of which hibernating larvae occurred in springs and a stream in a suburb of the town of Poltava, but no adults were observed in dwellings or animal quarters.

[ALMAZOVA (V. V.).] **Алмазова (В. В.). On the Mating of *Anopheles maculipennis messeae* in Captivity.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 453–454. Moscow, 1941. [Recd. 1943.]

In further experiments carried out in the province of Archangel [*cf. R.A.E.*, B **28** 38], newly emerged adults of *Anopheles maculipennis* var. *messeae*, Flni., were kept for 1–2 days in small cages containing sugar solution, and then liberated in the central compartment of the large insectary previously described

[**27** 74], in which sugar solution but no animal was provided. The mosquitos were active during the day, and pairing was observed, in some cases within 1½ hours of liberation. No activity occurred at temperatures of 12°C. [53·6°F.] or below. After 1–5 days, the females were given one or more blood meals and were kept in cages, which also usually contained sugar and water, at a temperature and humidity resembling those in day-time shelters. Some of the 1,667 females used oviposited, but only 12 batches of eggs were obtained, and only five of these hatched. Oviposition occurred from 12–13 days to a month after emergence, and all the eggs belonged to var. *messeae*.

[TIMROT (S. D.).] **Тимрот (С. Д.). Observations on the Hibernation of Mosquitos in Nature and on their Distribution in Autumn.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 455–456. Moscow, 1941. [Recd. 1943.]

A few unfed females of *Anopheles maculipennis* var. *messeae*, Flni., were found on 14th May in a small cave at the base of trees on a sandy projection of the bank of the Dvina in the province of Archangel. None occurred in the cave in summer, but over 100 females with a developed fat-body were observed there in September. During the summer, females containing blood were abundant in day-time shelters in a village a mile or more away and a few newly emerged mosquitos occurred in the forest in an empty broken-down hut about 270 yards from the cave and close to several small pools. In August, the number of mosquitos fell sharply in the village and rose steadily in the hut, and in September, hardly any mosquitos occurred in the village and fewer in the hut. Migration to the cave began on 2nd September at a mean temperature of 4·8°C. [40·64°F.] and was particularly pronounced on 12th September, when the mean temperature dropped to 1·9°C. [35·42°F.].

In September 1940, over 200 hibernating females were found in another small cave on the sandy bank of a tributary of the Dvina, the entrance to which was almost completely covered with roots and branches.

[GENDEL'MAN (Tz. A.).] **Гендельман (Ц. А.). On the Possibility of Hibernation of *Anopheles maculipennis* in natural Conditions.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 456–457. Moscow, 1941. [Recd. 1943.]

The view that hibernating females of *Anopheles maculipennis*, Mg., do not occur in the field in the province of Dniepropetrovsk [*R.A.E.*, B **27** 72] was confirmed by the failure to find any in over 100 tree holes and 100 plots of reeds examined in a locality on the banks of the river Samara, or in samples of hay and straw, or to catch them in the burrows of rodents [*cf.* **24** 265], which were warmed by means of a candle and had muslin placed over the entrance.

The conclusiveness of the author's work is questioned in an editorial note on the ground that he did not use mosquito traps or sticky glass plates, which have given positive results elsewhere [**24** 265 ; **26** 221].

[USTINOV (A. A.).] **Устинов (А. А.). Seasonal Changes of the Size of *Anopheles maculipennis* in Abkhazia.** [*In Russian.*]—*Med. Parasitol.* **10** no. 3–4 pp. 457–458. Moscow, 1941. [Recd. 1943.]

In Abkhazia, adults of *Anopheles maculipennis*, Mg., are larger in the mountains than along the coast. Thus, in females taken in July 1939 in a village situated at an altitude of over 1,700 ft. the wings were 0·82 mm. and the thorax and abdomen together 1 mm. longer than those of mosquitos caught at the same time near Sukhum. The average temperature in June and July is 5°C. [9°F.] lower in the mountain locality than in Sukhum, and the temperature of the water in the streams in which the mosquitos breed is 10–12°C. [50–53·6°F.] at the source and sometimes over 20°C. [68°F.] lower down their course. It

appeared likely, therefore, that the mosquitos were large because the larvae developed more slowly in the colder water, and that the sea-coast mosquitos would be equally large in spring. This was largely confirmed by measurement of females that were collected near Sukhum from April to October and were allowed to oviposit. The average measurements and numbers of eggs per batch for each month are given in a table. The results showed that the size of the mosquitos varied with the temperature; they were smallest in July–September, and those that emerged in May from larvae that developed in the second half of March and April were almost as large as the mosquitos taken in the mountains in June and July. The number of eggs per batch was directly related to the size of the mosquitos except in April, when only overwintered and young females were present, and October, when oviposition ceases.

HADDOW (A. J.). **Measurements of Temperature and Light in artificial Pools with Reference to the larval Habitat of** *Anopheles* (*Myzomyia*) *gambiae*, **Giles, and** *A.* (*M.*) *funestus*, **Giles.**—*Bull. ent. Res.* **34** pt. 2 pp. 89–93, 2 graphs, 2 refs. London, 1943.

As larvae of *Anopheles gambiae*, Giles, occur in exposed pools and puddles, and those of *A. funestus*, Giles, usually in waters shaded by standing herbage, their breeding habits may be related to temperature, as are those of certain species of *Anopheles* occurring in Assam [*R.A.E.*, B **29** 70]. Two series of hourly readings of temperature and light intensity, extending over 24 hours, were therefore made in artificial pools, at Kisumu, Kenya Colony. The pools and methods are described, and the results given. The first series of readings was made in a pool containing clear water, one containing muddy water and a third containing clear water with standing grass 1 ft. high. In the second series, three further pools completely shaded with two thicknesses of papyrus matting at heights of 1, 2 and 3 ft. were included. The results in these three were practically identical, and only those in the first are considered. Air shade temperature records were kept in a Stevenson screen. No essential temperature difference was noted between the two open pools or between the grassy pool with broken shade and the pool completely shaded by matting. The grass had a pronounced insulating effect on temperature, the range in the grassy pool being less than that in the screen and less than half that in the clear open pool. Both pools had about the same temperature as the air by night, that of the grassy one being rather the higher, but by day, the temperature in the grassy pool was lower, and that in the open pool higher, than the screen reading. Maximum light intensity in the grassy pool was less than half that in the open pool. Thus, the waters in which *A. gambiae* breeds not only reach much higher temperatures than those favoured by *A. funestus*, *A. coustani*, Lav., and *A. pharoensis*, Theo., but they also undergo much greater temperature fluctuations. The highest temperature recorded in the open pool and in natural breeding places of *A. gambiae* at Kisumu was 36·5°C. [97·7°F.]. Preliminary tests, in which groups of 10 larvae and an exposure of one hour were used, gave thermal death points of 42°C. [107·6°F.] for *A. gambiae* and 39°C. [102·2°F.] for *A. funestus*.

MACLEOD (J.). **A Survey of British Sheep Blowflies. II. Relation of Strike to Host and edaphic Factors.**—*Bull. ent. Res.* **34** pt. 2 pp. 95–111, 3 graphs, 8 refs. London, 1943.

The following is based on the author's summary of this paper, in which data collected between 1938 and 1942 on blowfly larvae from sheep in the British Isles [*R.A.E.*, B **31** 150] are collated from the point of view of the relation of strike to season, host and edaphic factors. The seasonal incidence of strike was divisible into four phases, the pre-shearing phase, which principally involved

ewes and was of importance in mountain breeds, which are shorn late, the shearing period, when strike was not plentiful and was confined to lambs, the phase dominated by increasing incidence of strike in lambs, and the late season phase when adults and lambs were affected to an approximately equal extent. This was much the most important phase in the lowlands. About two-thirds of the strikes reported by shepherds occurred on the hindquarters and nearly two-thirds of the remainder on the loins and back. In a lowland flock where all strikes were noted over a period of five years, the incidence of strikes on the hindquarters was only 43 per cent. The shoulders were highly susceptible in relation to their area [*cf.* **25** 53], particularly in lowland breeds. Rather more than half of the reported cases were in adult sheep [*cf.* **22** 132], and more than half of these in shorn sheep. Body strikes were relatively more common in shorn than in full-fleeced sheep. Species other than *Lucilia sericata*, Mg., occurred mostly in the mountain breeds or their lowland crosses, and more frequently in body than in breech strikes, both in adults and lambs. They attacked adult sheep and lambs to an almost equal extent, except that *Phormia terraenovae*, R.-D., was almost confined to adults. This is in agreement with its tendency to be an early-season species [**31** 150]. There was a significant relation between the occurrence of these species and the type of grazing land and the vegetation. Analysis of data indicated that, with the exception of *P. terraenovae* they struck sheep as a result of conditions closely associated with the presence of bracken or heather or both.

HOPKINS (G. H. E.). **Notes on Trichodectidae (Mallophaga).**—*Rev. brasil. Biol.* **3** no. 1 pp. 11–28, 21 figs., 4 refs. Rio de Janeiro, 1943.

Trichodectids from antelopes have been referred to the genera *Damalinia*, *Bovicola*, *Tricholipeurus* and *Holakartikos*, but the author concludes from a detailed discussion that they all belong to the genus *Damalinia*, and that *Bovicola* and *Tricholipeurus* are congeneric with it. He gives a list of the species of *Bovicola* referable to *Damalinia*, among which are *bovis*, L., *ovis*, Schr., and *caprae*, Gurlt [the genotype] and *limbatus*, Gerv. [two of the species from goats of which he has recently discussed the nomenclature (*R.A.E.*, B **31** 107)], and describes five new species of *Damalinia* from African antelopes.

IRWIN (W. H.). **The Mosquitoes of three selected Areas in Cheboygan County, Michigan.**—*Pap. Mich. Acad. Sci.* **28** (1942) pp. 379–396, 13 refs. Ann Arbor, Mich., 1943.

The following is based on the author's summary. A list is given of the six genera and 35 species of mosquitos found in the three areas studied, with data on the breeding places of most of them, including the ranges of variation of the principal chemical features of the waters in which the larvae occurred. Contrary to previous taxonomic descriptions, many adults of *Aëdes intrudens*, Dyar, lack lower mesepimeral bristles and numerous larvae of *Culex apicalis*, Adams, show a variation of 1–2 head hairs per trichopore.

MULHERN (T. D.). **New Jersey mechanical Trap for Mosquito Surveys.**—*Circ. N. J. agric. Exp. Sta.* no. 421, 8 pp., 2 figs., 4 refs. New Brunswick, N.J., 1942.

The New Jersey suction light-trap for mosquitos is described [*R.A.E.*, B **23** 151]. The killing jar contains a half-inch layer of calcium-cyanide crystals held in place by layers of cotton-wool and cardboard, and the insects fall into a waxed paper cup fitted tightly into the mouth of the jar and are killed by the gas that enters through small holes punched in the side. The trap is mounted on a post so that the edge of the roof is $5\frac{1}{2}$ feet from the ground. It is usually

put into and out of operation by an automatic switch, the standard operating period in New Jersey being 7 p.m. to 7 a.m. Notes are given on the location and operation of the traps and the interpretation of the results.

Shaw (A. O.), Smith (R. C.), Atkeson (F. W.), Fryer (H. C.), Borgmann (A. R.) & Holmes (F. J.). **Tests of Fly Repellents of known Ingredients and of selected commercial Sprays on Dairy Cattle.**—*J. econ. Ent.* **36** no. 1 pp. 23–32, 12 refs. Menasha, Wis., 1943.

The following is based on the authors' summary of this account of experiments carried out in Kansas in 1940 and 1941. The cows were divided into groups, usually of four, balanced according to susceptibility to flies, breed and milk production. Spraying periods of four days were used, and each group was sprayed with each material and served as a control. Since the distribution of fly numbers was definitely skewed, it was necessary to transform the data [*cf.* next paper] before statistical analysis of variance could be used in interpreting differences between sprays. Statistical analysis showed no significant differences between counts obtained by two operators, or in the relative constancy of fly susceptibility of individual cows and the accuracy of balancing groups.

Since *Lyperosia* (*Haematobia*) *irritans*, L., was easily repelled by any of the sprays, data on *Stomoxys calcitrans*, L., only are presented. The first trial in 1940 showed that a spraying of tap water was not significantly better than no spray. The over-all mean for a mixture of 3 per cent. Thanite [*cf. R.A.E.*, B **30** 141] and 97 per cent. of a base oil with a viscosity of 40 seconds Saybolt showed a highly significant difference from that for the control, and the difference by hourly counts was still highly significant at the last count, four hours after spraying. The second trial showed that mixtures of 1, 2 and 4 per cent. Thanite in base oil all caused a highly significant reduction in the numbers of flies as compared with the control. The difference between the over-all means for the 4 and 1 per cent. mixtures was highly significant, but the differences between the 2 per cent. mixture and the others were not consistently significant. The effectiveness of each spray diminished hourly, but all showed a highly significant difference from the control four hours after spraying. In the third trial, base oil alone showed a highly significant repellent effect after the morning spraying but a non-significant effect after the afternoon spraying, when compared with the control. A mixture of 5 per cent. of 20 : 1 concentrate of pyrethrum in base oil showed highly significant repellency when the over-all mean was compared with that of the control (or with that of base oil alone for morning spraying). Thanite (5 per cent.) in base oil reduced fly counts to a highly significant degree as compared with either control or base oil, but its superiority to the pyrethrum mixture was of minimal significance in the morning and insignificant in the afternoon. In the first test in 1941, 3·75 and 2·5 per cent. 20 : 1 pyrethrum concentrate with 10 and 15 per cent. Yarmor pine oil, respectively, in base oil, and 3 per cent. Thanite in base oil were all adjudged highly effective from comparison of their over-all means with those for the control groups. They ranked in the order given, but the difference between the two pyrethrum sprays was not significant. All the sprays were of approximately equal value from the third hourly count until the seventh. In the second test, D.H.S. Activator (ethylene glycol ether of pinene) in base oil was no more effective than no spray. Mixtures of 2·5 per cent. 20 : 1 pyrethrum concentrate plus 5 per cent. D.H.S. Activator in base oil and 3 per cent. Thanite in base oil were definitely repellent. The difference between their over-all means was not significant, but whereas the pyrethrum mixture was not significantly different from the control group after the first two hourly counts, the Thanite was significantly different for four hourly counts. The repellent effect of the sprays lasted about half as long as in the previous test.

An attempt was then made to bring together most of the previous comparisons in one trial. Six sprays were tested, and all showed highly significant repellence as compared with the control. The addition of 5 per cent. D.H.S. Activator or 15 per cent. Yarmor pine oil to a mixture of 2·5 per cent. 20 : 1 pyrethrum concentrate in base oil did not result in a significant difference in repellency, but the effectiveness of the spray was enhanced by increasing the proportion of pyrethrum concentrate to 5 per cent. The mixture of 3 per cent. Thanite in base oil was superior to any of the other sprays as indicated by highly significant differences between the over-all means, and raising the Thanite content to 5 per cent. increased effectiveness. The differences between all the sprays and the control were still highly significant $7\frac{1}{2}$ hours after spraying. Thanite was more lasting in its effect than any of the other sprays. Four commercial brands of fly-spray and the home-made mixture recommended by the United States Department of Agriculture [**28** 205] were compared with 3 per cent. Thanite in base oil in the final test. The Thanite mixture was the most effective, but the difference between it and the home-made spray was not significant. The difference between Thanite and the best commercial spray was beyond reasonable sampling variation.

FRYER (H. C.), SHAW (A. O.), ATKESON (F. W.), SMITH (R. C.) & BORGMANN (A. R.). **Techniques for conducting Fly-repellency Tests on Cattle.**—*J. econ. Ent.* **36** no. 1 pp. 33–44, 3 figs., 19 refs. Menasha, Wis., 1943.

The following is taken from the authors' summary. A review of the literature on cattle fly-spray tests indicates that, although considerable progress has been made in developing general techniques and in discovering the variables involved, the conclusions drawn are supported by very little data and few statistical analyses. Periodic counts of the flies present on cows are distributed in a Poisson-like manner that is not even approximately normal. This prevents the use of statistical techniques based on normal distributions unless the data can be normalised to a satisfactory degree. Statistical research has led to a general method for determining a transformation that will usually normalise a set of such data satisfactorily. The application of that procedure to the data obtained from a comparison of six repellent sprays and a control produced a new transformation, the reciprocal square root transformation $(y=1/\sqrt{x+10})$, which was successful under the peculiar circumstances of fly-spray research, whereas previously used ones were not. It appears that a randomised latin square design on balanced groups of cows [*R.A.E.*, B **21** 110] and different periods of time during the summer is well adapted to cattle fly-spray research. A general design for a one-half cow method of testing sprays [*cf.* **30** 70], which would standardise the test and make a statistical analysis of the data possible, is suggested, but if practical difficulties make it impossible to compare properly two different sprays on the same cow, the newer design would not make the technique satisfactory.

Evidence from analyses of actual data indicates that a well-chosen transformation will increase considerably the precision of the spray comparisons and the study of the lasting effects of sprays throughout the day. Analyses of variances have shown that groups of three or four cows can be balanced with regard to susceptibility to flies in the presence of a fairly wide range of individual cow susceptibilities and over a period of several weeks. There was no day × group interaction. Analyses indicated that the cow-within-group variability is approaching non-homogeneity for groups of three cows. This can be remedied by a more careful selection of the groups or by using more cows per group. There was considerable day-to-day variation over a four-day period for the whole herd involved in the experiments, but in the absence of a day × group interaction, it is quite likely that a smaller number of days could be used if

necessary. It is recognised that the process of transforming data to normalise their distribution might benefit by further research designed to make the method more objective and rigorous. However, it is believed that the statistical procedures and the points of view presented can be made the basis for a standard and acceptable method for cattle fly-spray tests.

Bradley (G. H.) & Travis (B. V.). **Time-saving Methods for handling Mosquito Light-trap Collections.**—*J. econ. Ent.* **36** no. 1 pp. 51–53. Menasha, Wis., 1943.

Methods and devices are described by means of which it is possible to increase the speed with which mosquitos collected from light-traps can be sorted, and counted when identified. It was found that a cup of copper gauze, fitted into the killing jar of the light-trap [*cf. R.A.E.*, B **31** 195] to receive the insects, kept them in good condition, as they did not come into contact with the moist cyanide. Analysis of the records of collections from four traps operated daily in Florida from May to October 1941 showed that, for practical purposes, satisfactory estimates of abundance can be obtained by operating the traps every second or third day instead of daily. Also, when there are several hundred mosquitos in a single collection, it is practical to identify only a quarter or a half of the catch.

Deonier (C. C.) & Lindquist (A. W.). **Studies on Ovicides for the Clear Lake Gnat.**—*J. econ. Ent.* **36** no. 1 pp. 54–56, 3 refs. Menasha, Wis., 1943.

A series of 900 laboratory tests was made in the summer of 1940 on the effectiveness of oils, oil emulsions and various organic substances against the eggs of *Chaoborus astictopus*, Dyar & Shann., as destruction of the egg drifts [*cf. R.A.E.*, B **31** 48] appeared to be one of the most logical ways of controlling the gnat at Clear Lake, California. The materials and methods are described. The sprays were applied at 0·2, 1, 2·5 and 5 cc. per jar, the weakest of these rates being equivalent to 44·8 U.S. gals. per acre. The results are shown in a table. The eggs were fairly resistant to all the materials tested. Some formulae gave good kills when the egg films were free from débris, but they were not effective when the eggs were partly protected by a scum of pupal skins and dead adults. As Clear Lake is used extensively for recreational purposes, the use of ovicides containing a large percentage of oil would be objectionable. Moreover, fish might suffer if subjected to appreciable quantities of poisons. The high concentrations and large amounts of material required to kill a high percentage of the eggs made ovicides less promising as a control measure than burning with petrol [*loc. cit.*].

Hutzel (J. M.). **Sodium Fluoride Crayons for Roach Control.**—*J. econ. Ent.* **36** no. 1 pp. 67–69, 3 refs. Menasha, Wis., 1943.

It appeared that the efficiency of sodium fluoride for the control of *Blattella germanica*, L., would be increased and the danger of its use lessened if it could be moulded into crayons that could be used to apply lines of poison. Preliminary tests showed that if an adult male picked up more than 0·3 mg. sodium fluoride on its tarsi in crossing a deposit of powder, it would almost certainly die, but that it would probably survive if it picked up less than 0·1 mg. The rate of mortality of cockroaches that crossed a strip of the powder increased with the width or depth of the deposit. The addition to the powder of 6 per cent. of a motor oil, to increase the quantity adhering to the tarsi, halved the deposit required in a strip 6·4 cm. wide, but it was still more than could be left by a crayon mark of practical width (*e.g.*, 3·7 cm.). However, this did not exclude the possibility of the method being effective if the cockroaches were

likely to cross the deposit several times. Crayons made by pounding moist sodium fluoride into a metal tube and drying it were used to mark a line across the rough bottom of each of a number of rearing drawers containing 60–100 cockroaches. Food and water were placed on one side of the line and shelters on the other. More than 95 per cent. of the cockroaches died within 24 hours. A lighter line on celluloid was less effective. Better results were obtained with crayons made with unoiled than with oiled powder. The process of making the crayons is briefly described. Practical trials of the crayons in the kitchen of a restaurant, a grocery store and a flat showed them to be effective, safe, convenient and economical. They made it possible to deposit sodium fluoride on vertical surfaces, which it is otherwise impossible to treat. If the marks are not disturbed, they remain operative for an indefinite period.

Schwardt (H. H.) & Matthysse (J. G.). **New Recommendations for large scale Control of the Sheep Tick in the Northeast.**—*J. econ. Ent.* **36** no. 1 pp. 105–107, 4 figs. Menasha, Wis., 1943.

The control of *Melophagus ovinus*, L., is an annual problem in New York State, and most of the sheep are dipped in portable vats owned by the county farm bureaux. An account is given of the construction and use of such a vat and of the results of experiments with dips, in which it was the type chiefly employed. Each sheep should be kept in the liquid for about 20 seconds. Only three of a large number of formulae justified large-scale tests. These were 100 lb. wettable sulphur in 1,000 U.S. gals. water alone or in combination with 10 lb. cubé (5 per cent. rotenone) or 10 lb. fixed nicotine (Black Leaf 155). The dry ingredients should be made into a paste with a little water, the paste well mixed with the water in the tank, and the sheep sent through immediately. One dipping in the suspension containing cubé completely eradicated *M. ovinus* from some 2,000 sheep treated experimentally and about 10,000 treated in practice. The pupae survived, but the residue remained effective long enough to kill the adults as they emerged. *Damalinia* (*Trichodectes*) *ovis*, L., was also eradicated. In most cases, sulphur alone eradicated *M. ovinus*, but was slow, requiring 6–8 weeks. The dip containing fixed nicotine usually gave complete control, but there was one conspicuous failure. This was probably attributable to weakening of the dip by drainings, which were almost all returned to the vat, a permanent concrete one. Probably on account of its solubility, nicotine sulphate used at the same nicotine concentration gave incomplete kills in most flocks, and left only about half as much nicotine in the wool. About 1 U.S. gal. of dip per sheep is required soon after shearing and 2 U.S. gals. in late summer or early autumn.

Ingle (L.). **An Apparatus for testing chemotropic Responses of flying Insects.**—*J. econ. Ent.* **36** no. 1 pp. 108–110, 1 fig., 3 refs. Menasha, Wis., 1943.

The following is based on the author's summary. An apparatus is described that employs blue light to attract house-flies [*Musca domestica*, L.] or stable flies [*Stomoxys calcitrans*, L.] to screens for the purpose of testing their response to different substances present on one of the screens. Subjection of flies directly to the test materials present in the state in which they would be used in field tests evokes a response that represents a summation of the organism's receptor system. The apparatus is simple in construction and easily used and gives a fair picture of the effectiveness of any given material as a repellent or attractant. Response to odours can also be tested.

Clarke (J. L.). **Studies of the Flight Range of Mosquitoes.**—*J. econ. Ent.* **36** no. 1 pp. 121–122. Menasha, Wis., 1943.

Mosquito larvae were abundant in 1942 in pools about 12 acres in extent left after flood waters had receded from a large marsh in Illinois. As soon as the

males began to emerge, the area was dusted with aniline dye so that the flight of the adults could be traced. Four different colours were used on successive days, the entire brood being stained in this way. Twelve New Jersey light-traps situated 1–14 miles from the marsh were operated every night for 17 nights and subsequently twice weekly until the 52nd day. The total number of mosquitos caught was 23,000, and 32 stained males and 40 stained females were found among the 4,378 males and 7,629 females examined. The number of individuals of each sex of the five species taken and the distances from the marsh are shown in a table. The figures for *Aëdes vexans*, Mg., and *Culex pipiens*, L., the only species caught in considerable numbers, prove that, contrary to expectation, the males fly as far as the females; 6 females and 9 males of the former and 10 females and 2 males of the latter were taken 14 miles from the marsh. Another table shows the average and maximum distances flown by stained adults of the different species taken on each of the first 14 days after the application of the various colours. The maximum distances flown by *A. vexans* and *C. pipiens* on the first day were 14 and 9½ miles, respectively. These distances were covered in 4–16 hours. The mosquitos of other species recovered comprised two females of *Theobaldia* (*Culiseta*) *inornata*, Will., at distances of 1 and 14 miles from the marsh, two females of *Anopheles punctipennis*, Say, at 8 and 10½ miles, and one female of *Anopheles quadrimaculatus*, Say, at 8 miles.

SALT (R. W.) & MAIL (G. A.). **The Freezing of Insects—a Criticism and Explanation.**—*J. econ. Ent.* **36** no. 1 pp. 126–127, 4 refs. Menasha, Wis., 1943.

The authors point out that Mail, in his paper on the low temperatures lethal to *Dermacentor andersoni*, Stiles, and other ticks [*Ixodes ricinus californicus*, Banks, *I. texanus*, Banks, and *Haemaphysalis cinnabarina*, Koch] in British Columbia [*R.A.E.*, B **31** 94] assumed that the observed rebound points were close enough to the freezing points to be referred to as the freezing points, whereas in fact they were much lower, the heat given off in a freezing insect or tick being insufficient to raise the temperature of the whole of its body to its true freezing point because the surroundings absorb too much of it. The freezing point can be determined indirectly by finding the melting point, which is the same in an aqueous system. This is indicated in soft-bodied insects by the change from physical hardness to softness, due to the melting of the body fluids [*cf.* A **25** 724]; no method has been published of determining the melting points of hard-bodied Arthropods without macerating them or piercing them with a thermocouple. The last method reduces undercooling, possibly because the liquid exuding at the wound acts as bulk water, which undercools but a few degrees, or because the metallic thermocouple forms the nucleus of crystal formation when placed within tissue.

LUND (H. O.). **Horsefly Control incidental to Mosquito Control.**—*J. econ. Ent.* **36** no. 1 p. 127. Menasha, Wis., 1943.

On 25th September 1942, 28 adult Tabanids, about half of which were females, were recovered by dipping from a 15-foot length of a ditch 3 feet wide in North Carolina that had been sprayed with fuel oil several days previously for the control of mosquito larvae. At the same time, several others were seen to dip into the water and then fly off. On the following day, 184 Tabanids were collected from a small oiled pool filled with algae, 8 feet long, 4 feet wide and about 6 inches deep. In this case, 46 individuals in a sample of 50 were males. The flies were identified as *Tabanus sulcifrons*, Macq., and *T. giganteus*, Deg.

Gwatkin (R.), Painter (R. H.) & Moynihan (I. W.). **Tularaemia in Sheep.**—*Canad. J. comp. Med. vet. Sci.* **6** no. 6 pp. 163–168, 2 figs. 1942. (Abstr. in *Exp. Sta. Rec.* **88** no. 1 p. 102. Washington, D.C., 1943.)

An account is given of an outbreak of tularaemia in a flock of 850 yearling ewes in southern Alberta. There were 24 fatal cases, but five or six seriously affected animals recovered. All the ewes examined were heavily infested with *Dermacentor andersoni*, Stiles, which was unusually abundant at the time. *Bacterium* (*Pasteurella*) *tularense* was recovered from one sheep on autopsy, from engorged ticks taken from it and from engorged ticks taken from another sheep that had been ill for ten days and was recovering. The outbreak lasted only five days, and its cessation coincided with the disappearance of the ticks.

Wheeler (C. M.). **A Contribution to the Biology of** *Ornithodoros hermsi* **Wheeler, Herms and Meyer.**—*J. Parasit.* **29** no. 1 pp. 33–41, 2 figs., 15 refs. Lancaster, Pa., 1943.

This account of the bionomics of *Ornithodoros hermsi*, Wheeler, a tick apparently restricted to the mountainous regions of the western United States, is based principally on laboratory work [*cf. R.A.E.*, B **24** 207], but includes a few observations made by the author in the field [*loc. cit.*] and other records [*cf.* **28** 99 ; **30** 89]. The methods of rearing the ticks and feeding them on white mice, and details of the processes of oviposition, hatching and moulting are described. The main results obtained in life-history studies on 168 larvae, representing the first batch of eggs deposited by each of three females, differ only slightly from those already noticed [**24** 207]. Details are given of the duration of the pre-feeding, feeding and post-feeding periods in the feeding instars. One female caught as an adult lived well over seven years, and others reared in the laboratory were alive after almost as long a period. Larvae and first-stage nymphs survived starvation for periods up to 125 and 154 days, respectively, and some fed adult females had not died nearly $4\frac{1}{2}$ years after their last feed. Data on the usually severe effect of bites of Argasid ticks are reviewed from the literature, and the reactions of man, monkeys and mice to those of *O. hermsi*, which appear to be quite benign [*cf.* **27** 131] are described.

Brody (A. L.) & Knipling (E. F.). **Can Larvae of** *Cochliomyia americana* **C. and P. mature in Carcasses ?**—*J. Parasit.* **29** no. 1 pp. 59–60, 1 ref. Lancaster, Pa., 1943.

An account is given of experiments carried out in southern Georgia in 1936–39 to determine what age a larva of *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) must reach in a live animal in order to be able to complete its development in the carcass [*cf. R.A.E.*, B **29** 82]. Animals were infested with newly-hatched larvae and killed after varying periods. Some of the carcasses were exposed to carrion-feeding insects and some protected from them. All were sheltered from rain. Larvae only 24 hours old at the death of the host matured when the carcasses were screened, and gave rise to adults that laid viable eggs, but younger ones did not mature, though Melvin & Bushland reared such larvae on a diet of meat and blood [**29** 132]. The larvae also continued to develop in exposed carcasses, but those that had not matured by the third day had little or no chance of survival, owing to competition with the numerous carrion-feeding larvae, which usually overran the carcass on that day. The youngest larvae to give rise to adults in unscreened carcasses were 30 hours old at the death of the host ; this was in one test only in which the blowfly population was very low. The chance of survival for larvae 48 hours old was greater and for those 54 hours old was very large. There was no indication that the number of larvae per wound had any effect on the number of mature larvae recovered.

Steinhaus (E. A.). **A new Bacterium,** *Corynebacterium lipoptenae,* **associated with the Louse Fly,** *Lipoptena depressa* **Say.**—*J. Parasit.* **29** no. 1 p. 80. Lancaster, Pa., 1943.

A description is given of the morphological and cultural characteristics of *Corynebacterium lipoptenae*, sp. n., which was observed in large numbers in the crushed abdomens of examples of the Hippoboscid, *Lipoptena depressa*, Say, from deer in south-western Montana. The organism, which may be symbiotic, appeared to occur chiefly in the intestinal tract. It was not pathogenic to laboratory rodents.

Miller (M. A.). **Studies on the developmental Stages and Glycogen Metabolism of** *Macracanthorhynchus hirudinaceus* **in the Japanese Beetle Larva.**—*J. Morph.* **73** no. 1 pp. 19–33, 7 pls., 25 refs. Philadelphia, Pa., 1943.

In experiments in Washington, larvae of *Popillia japonica*, Newm., readily became infested by *Macracanthorhynchus hirudinaceus*, when in moist soil inoculated with embryos of the worm. The larvae were kept at 20°C. [68°F.], and fully developed acanthellas were found in them after about four months, indicating that *P. japonica* is a potential source of infestation of pigs. Several larvae of *Aserica* (*Autoserica*) *castanea*, Arr., were similarly infested and individuals of both species still harboured the worms after transformation to pupae or adults. Individual larvae of *Popillia* contained from ten to over 300 parasites, but some of them invariably became encysted, a process that was eventually followed by their disintegration. In the older infestations, the great majority were encysted ; one pupa of *Popillia*, infested as a larva 82 days before, contained 78 encysted larvae and only three normal ones, and one adult of *Aserica* contained only three parasites. This suggests that the ability of some hosts to encyst the parasites enables them to live longer than their fellows.

The initial rate of mortality of the infested larvae was high ; 49 out of 119 died in the first fortnight and 38 more in the next four weeks, but it was uncertain whether their death was due to the parasite or to handling, as they were transferred from one lot of soil to another early in the experiment. Observations of other workers indicate that larvae of *Melolontha melolontha*, L. (*vulgaris*, F.) soon die when parasitised by *Macracanthorhynchus* whereas those of *Cetonia aurata*, L., usually survive, the few that die being probably killed by handling.

Details are given of the glycogen contents of the larval parasites in various stages and of their hosts.

Gould (G. E.). **The Effect of Temperature upon the Development of Cockroaches.**—*Proc. Ind. Acad. Sci.* **50** (1940) pp. 242–248. Indianapolis, Ind., 1941. [Recd. 1943.]

The following is based almost entirely on the author's summary of this paper, in which are given additional data on the temperature-development relationship in the six species of cockroaches that have been found in dwellings in Indiana [*cf. R.A.E.*, B **29** 55]. The three common species, *Blattella germanica*, L., *Periplaneta americana*, L., and *Blatta orientalis*, L., showed a decided similarity in temperature requirements. The range of 74–83°F. was the most favourable for incubation and nymphal development. *Supella supellectilium*, Serv., required higher temperatures for normal development, while *Parcoblatta pensylvanica*, Deg., responded to lower ones. *Periplaneta fuliginosa*, Serv., resembled *P. americana* in its response to temperature ranges. Acceleration of development of all the species continued up to 84°F. and in some cases even higher, but higher temperatures were detrimental to capsule production and shortened the lives of adults.

Getting (V. A.). **Equine Encephalomyelitis in Massachusetts. An Analysis of the 1938 Outbreak, a Follow-up of Cases and a Report of a Mosquito Survey.** —*New Engl. J. Med.* **224** no. 24 pp. 999–1006, 5 figs., 16 refs. Boston, Mass., 1941. [Recd. 1943.]

An account is given of the outbreak of encephalitis in man caused by the virus of eastern equine encephalomyelitis and associated with a more extensive outbreak of this disease in horses that occurred in south-eastern Massachusetts in 1938 [*R.A.E.*, B **29** 38], a year in which exceptionally heavy rainfall resulted in an abundance of mosquitos. The disease spread in a north-easterly direction with the prevailing winds. There were no records of more than one case in the same family and very few of more than one among horses on the same farm or in the same stable. Of the 34 proved and typical human cases, 25 were fatal, and disabling sequelae developed in six of the others. During a State-wide mosquito survey made in July-October 1939, 56 species were collected, six of which have been shown to transmit the virus of eastern equine encephalomyelitis. These were the five local species of *Aëdes* with which Davis obtained positive results [**29** 39] and *A. taeniorhynchus*, Wied., which was taken in small numbers only, but which transmitted the virus in experiments reported by C. Ten Broeck and M. H. Merrill in 1935. The seasonal prevalence of these six mosquitos corresponded with the course of the outbreak. Only *A. vexans*, Mg., and *A. triseriatus*, Say, were present in all places where cases occurred, and as the former is 5–15 times as numerous as the latter, it is probably the chief vector [*cf. loc. cit.*]. The distribution of cases among horses in 1939 indicated that it was unlikely that any one of the three species of salt-marsh mosquitos, which were not collected more than 15 miles from their breeding places, was implicated, but *A. sollicitans*, Wlk., and *A. cantator*, Coq., may have been partly responsible for the outbreak in 1938 in the coastal region. Of the 34 human cases, 9 were in infants less than one year old and 15 in children 1–9 years old. This may be attributable to the fact that children spend much of the day out of doors and seldom react to the presence of a mosquito until it has bitten them. Cases in horses were most numerous in animals kept out of doors, and 60 per cent. of all mosquitos caught on man out of doors and only 6 per cent. of those caught indoors were vectors.

Watson (D. W.) & Smadel (J. E.). **Susceptibility of Hamsters to peripheral Inoculation of Western, Eastern, and West Nile Encephalitis Viruses.**—*Proc. Soc. exp. Biol.* **52** no. 2 pp. 101–104, 19 refs. New York, N.Y., 1943.

Philip (C. B.) & Smadel (J. E.). **Transmission of West Nile Virus by infected** *Aëdes albopictus*.—*Op. cit.* **53** no. 1 pp. 49–50, 5 refs. 1943.

It is shown in the first paper that the Syrian hamster [*Cricetus auratus*] can readily be infected with eastern, western or West Nile encephalitis by peripheral inoculation of a small amount of virus. The viruses appear in the circulating blood and the diseases usually terminate fatally. The hamster should, therefore, prove useful in experiments dealing with the transmission of these three agents by insects.

In the second paper, an account is given of experiments in which *Aëdes albopictus*, Skuse, transmitted the virus of West Nile encephalitis in one series of tests out of three. This virus [which was first isolated in December 1937 from the blood of a native woman with fever in the West Nile district of Uganda] is a neurotropic agent related immunologically to the viruses of St. Louis and Japanese encephalitis and has apparently caused human infection in widely scattered communities in equatorial Africa. In the positive series of tests, the mosquitos were allowed to feed on the shaved abdomens of infected hamsters and transmitted the disease to most of the susceptible hamsters on which they fed 10–26 days after the infective meal. One of the hamsters was infected by only three mosquitos.

SMITH (D. J. W.). **Studies in the Epidemiology of Q Fever. 10. The Transmission of Q Fever by the Tick** *Ixodes holocyclus* **(with Notes on Tick-paralysis in Bandicoots.)**—*Aust. J. exp. Biol. med. Sci.* **20** pt. 3 pp. 213–217, 4 refs. Adelaide, 1942. **11. Experimental Infection of the Ticks** *Haemaphysalis bispinosa* **and** *Ornithodorus* **sp. with** *Rickettsia burneti*.—*T.c.* pt. 4 pp. 295–296, 2 refs.

The two commonest ticks on bandicoots (*Isoodon torosus*) in southern Queensland are *Haemaphysalis humerosa*, Warb. & Nutt. [*R.A.E.*, B **28** 227 ; **29** 53] and *Ixodes holocyclus*, Neum. The latter is the tick most commonly found attacking man in Australia, and its range includes the whole of the known Q fever area except Moreton Island [*cf.* **31** 105]. It is confined to a narrow coastal belt extending from northern Queensland to the southern border of New South Wales, its principal hosts in the two States being the bandicoots, *Isoodon torosus* and *Perameles nasuta*, respectively. *I. torosus* is a proved reservoir of Q fever [**28** 227, 228]. No natural infection was found among more than a hundred nymphs and adults of *Ixodes holocyclus* and 111 larvae taken from bandicoots in Queensland between October 1937 and August 1938 inclusive, but larvae, nymphs and adults were infected experimentally by feeding on infected bandicoots or guineapigs, and the infection was passed from larvae to nymphs and from nymphs to female adults, but not from females to their progeny. An infected adult transmitted the disease to a bandicoot by feeding. In two infected females examined by serial section, rickettsiae (*Rickettsia burneti*) were seen only in the lumen of the gut and the cytoplasm of its epithelial cells. It is considered that the tick may spread infection among native animals, transfer it to domestic animals from which man can become infected, and infect man directly [*cf.* **31** 105].

I. holocyclus causes tick-paralysis in man and domestic animals in Australia [**15** 32 ; **30** 28], and it also caused it in bandicoots from areas near Brisbane where it is rare or absent, larvae and nymphs as well as adults producing the disease when present in sufficient numbers. Three animals that received canine anti-tick serum developed symptoms of the disease, but survived.

The information in the second paper includes the results of experiments on the transmission of Q fever by *Haemaphysalis bispinosa*, Neum., a three-host tick that infests cattle in the coastal districts of southern Queensland and northern New South Wales [**31** 106]. The experiments were carried out with uninfected females collected from sheep and cattle and with their progeny, but did not include any on hereditary transmission. The infection was acquired by larvae, nymphs and adult females that fed on infected animals and was passed from larva to nymph and from nymph to adult. Nymphs transmitted the disease to a rabbit and a guineapig by feeding. In infected females examined by serial sections, rickettsiae, which were often abundant, appeared to be limited to the lumen and lining epithelium of the midgut and its caeca. They were seen only in the cytoplasm of infected cells. It is concluded that *H. bispinosa* probably spreads Q fever among cattle and that it may possibly also carry it to cattle from bush animals, as it has a wide range of hosts in other countries.

In October 1940, one adult and six nymphs of a species of *Ornithodoros*, collected in a cave in north-western Queensland and provisionally identified as *O. gurneyi*, Warb., were fed on febrile guineapigs infected with Q fever. They failed to transmit the disease by feeding 20–143 days later, but three were shown by inoculation to have retained infection of apparently undiminished virulence for 129, 135 and 538 days. The feeding experiments failed probably because the wound did not become contaminated with infected material from the hindgut during the short time that the ticks were on the host. The coxal fluid is apparently not infective.

GEAR (J.) & DE MEILLON (B.). **The hereditary Transmission of the Rickettsiae of Tick-bite Fever through the Common Dog-tick,** *Haemaphysalis leachi*.—*S. Afr. med. J.* **15** pp. 389–392, 2 figs., 5 refs. Cape Town, 1941. [Recd. 1943.]

The following is substantially the authors' summary. Two series of experiments are described, in each of which the transmission of the rickettsiae causing South African tick-bite fever through the egg of *Haemaphysalis leachi*, Aud., to the succeeding generation was demonstrated [*cf. R.A.E.*, B **30** 19]. It was further shown in the first series that this transmission took place through the eggs of the second generation to the third generation. It is therefore surmised that the hereditary transmission of tick-bite fever in the tick may continue through an indefinite number of generations. In both series of experiments, it was shown that all mobile stages of the tick can transmit the disease. It was further proved that the nymphs can do so for as long as five months, a time approaching the limit of life of the unfed nymph. The infection did not apparently have any deleterious effect on any stage of the tick.

Memorandum on Control of Head Lice.—*Mem. Med. Minist. Hlth* no. 230A, 4 pp. London, 1943. Price 1*d.*

Lethane hair oil, which consists of equal parts of white oil and lethane 384 special (12·5 per cent. N-butyl carbitol thiocyanate, 37·5 per cent. beta-thiocyanoethyl laurate and 50 per cent. refined paraffin), is recommended for the control of head lice [*Pediculus humanus capitis*, Deg.] as a result of laboratory and practical trials made by a technical committee at the instance of the Ministry of Health. Further consideration of 25 per cent. technical lauryl thiocyanate in white oil [*cf. R.A.E.*, B **30** 99], which is stated to be undoubtedly lethal to lice and their eggs, was postponed in view of the difficulty of obtaining supplies, the fact that some reactions were noted in young children and the evidence accumulated in favour of the lethane hair oil. In one group of young women whose hair was treated with lethane hair oil and washed the following day, living lice were not found 24 hours after the application. Of 8,746 women whose hair was not washed until a week after treatment, only 80 had living lice 1–3 weeks after treatment. No injurious effects were reported. Conspicuous success is also recorded in the use of lethane hair oil for the control of head lice on children in various circumstances. From trials by the school medical services with oil containing lethane or lauryl thiocyanate and with derris cream [*loc. cit.*], Glover concludes that lethane hair oil is the best, but stresses the importance in the case of school children of preceding application with the customary shampoo and combing except in emergency. The oil will then inhibit reinfestation and allow time, where necessary, for family contacts to be disinfested. Neither carefully controlled experiments with laboratory animals by G. R. Cameron [*cf.* **27** 251 ; **31** 38] nor the series of trials reported in this paper suggest that the use of lethane hair oil is likely to produce toxic symptoms. Whatever preparation is applied to the skin, there are likely to be occasional cases of dermatitis among persons with unusually sensitive skins. In prescribing lethane hair oil, it is important to specify lethane 384 special. This substance and, to some extent, derris cream have slightly disagreeable odours, but these can be easily masked by the addition of 2 per cent. oil of citronella or a similar essential oil, if it is thought desirable. In limited trials by the Committee, creams of derris or cubé were efficient, and cases of reinfestation were rare, but application is slow, the hair becomes greasy if too much cream is used, and inflammation was reported in a number of cases. Rotenone powders were effective, and would

probably be of value for treating patients who are too ill to be disturbed. The most satisfactory one was designated H.D.23. None of a number of other substances tested showed the lasting effects of the thiocyanates.

Gamlin (R.). **Control of Head Lice.**—*Brit. med. J.* no. 4298 p. 647. London, 1943.
Busvine (J. R.). **Control of the Head Louse.**—*Op. cit.* no. 4301 pp. 734–735.
Gamlin (R.). **Control of the Head Louse.**—*Op. cit.* no. 4304 pp. 20–21.

In the first of these papers, the effectiveness of thiocyanates against eggs of the head louse [*Pediculus humanus capitis*, Deg.] is questioned. Live larvae were found in 35 per cent. of cases treated with lethane hair oil in experiments in Liverpool, 1–3 weeks after the application. Opportunities for reinfestation were practically negligible. The lice were almost always very small and were found by examining combings with a magnifying glass. It is thought that the degree of success claimed by the Committee [see preceding abstract] may be attributable to failure to detect such small larvae. The Liverpool experiments indicated that lethane kills lice but not eggs ; it did not kill the newly hatched larvae for more than a day or two after application. Experiments in which lice died after an hour or less in vessels at the bottom of which were a few drops of lethane with which they could not come in contact showed that lethane possesses a volatile lethal factor. As a result of experiments with various modifications of the lethane treatment extending over a year, it is suggested that the hair be first saturated with a 2 per cent. solution of lysol at a temperature of about 104°F., then combed by the usual methods for the removal of lice and eggs, and finally treated with lethane hair oil as recommended by the Ministry of Health. No evidence of infestation was found in 90 cases so treated and followed up for three weeks, but there were 10 per cent. failures when the lysol was used cold. Care must be taken to protect the eyes from both the lysol solution and the lethane.

In the second paper, it is stated that laboratory spraying tests showed that complete kill of eggs can be effected by 0·036 mg. per sq. cm. of butyl carbitol thiocyanate (β-butoxy-β′-thiocyanodiethyl ether) or by 0·186 mg. per sq. cm. of lauryl thiocyanate. It is concluded that failure to kill eggs in practice is due to the difficulty of wetting every egg on the head with a small amount of fluid. The volatile principle in lethane 384 special is stated to be butyl carbitol thiocyanate. Buxton and the author obtained about 95 per cent. success among cases treated with one application of lethane hair oil only, and two treatments at an interval of a week should therefore practically eliminate failures.

In the third paper, it is recorded that in a recent experiment, 100 heads were treated with 3 drachms each of lethane hair oil [*cf. R.A.E.*, B **30** 99] distributed as effectively as possible and that nevertheless the percentage of failures after two weeks was 20. No failures were recorded among a further 100 cases in which the hair was first soaked with 2 per cent. hot lysol.

Davidson (J.). **Flies, Fleas and Lice.**—*Med. J. Aust.* 15th August 1942 p. 111 repr. 8 pp., 31 refs. Sydney, 1942.

The increased importance that flies, fleas and lice assume in time of war as vectors of disease is stressed, with reference to the possibility of the outbreak of epidemics under war conditions in Australia. The flies concerned are likely to include *Musca domestica*, L., in houses, living huts, mess huts and kitchens and *M. vetustissima*, Wlk., and blowflies under more open-air conditions.

Little information is available on the species present in camps in Australia, or their habits. The bionomics of *M. domestica* and methods of controlling flies in field-service camps and mobile units are given.

The fleas commonly met with are *Pulex irritans*, L., *Ctenocephalides canis*, Curt., and *C. felis*, Bch., and also *Xenopsylla cheopis*, Roths., *Ceratophyllus fasciatus*, Bosc, and *Leptopsylla segnis*, Schönh., if domestic rats and mice are present. The bionomics of fleas are dealt with in a general way, brief notes are given on their control, and the part they play in the transmission of plague, including the sylvatic form which has not been found in Australia, is explained.

Pediculus humanus humanus, L. (*corporis*, Deg.) and *P. humanus capitis*, Deg., are associated with man in all parts of the world. Their incidence in England and among British troops abroad in the war of 1914–18 are discussed, brief notes are given on their life-history, and the transmission by them of epidemic typhus, murine typhus that has become established in man through the agency of fleas, and louse-borne relapsing fever, which has not been recorded from Australia, is discussed. Recommendations are made for the control of head and body lice on the person and on clothing.

DA COSTA LIMA (A.). **Insetos do Brasil. 4° Tomo. Panorpatos—Suctórios (pulgas)—Neurópteros—Tricópteros.**—141 pp., 96 figs., many refs. Rio de Janeiro, Escola nac. Agron., 1943.

The four chapters of this volume deal respectively with the Mecoptera, Siphonaptera, Neuroptera and Trichoptera; for each of these Orders an account of the morphology and biology is given, with information on species that are common or of economic importance in Brazil, keys and a bibliography. The chapter on fleas includes a brief discussion from the literature of the part played by them in the transmission of plague and a note on their control.

FERNALD (H. T.) & SHEPARD (H. H.). **Applied Entomology. An introductory Textbook of Insects in their Relations to Man.**—4th edn. (revd.), Demy 8vo, ix+400 pp., 383 figs. New York & London, McGraw-Hill Book Co., Inc., 1942. Price 24*s*. 6*d*.

The general arrangement of the subject matter in this fourth edition is the same as in previous ones [*cf. R.A.E.*, B **10** 35], but the information on insecticides has been brought up to date and the chapters dealing with them and with general control methods and the economic importance of insects have been rewritten. There are some alterations in the text and sequence of the chapters on the individual insect Orders and the one on other injurious animals, chiefly Arthropds, with which entomolgists may be concerned. They are illustrated by reference to species of importance in the United States as pests of agricultural crops or as medical or veterinary pests, for most of which control measures are given.

CHORLEY (T. W.). **An unusual Occurrence of** *Ornithodoros moubata* **(Arachnida).**—*Proc. R. ent. Soc. Lond.* (A) **18** pt. 4–6 p. 27, 1 ref. London, 1943.

One of two wart-hogs (*Phacochoerus aethiopicus*), shot in Karamoja, Uganda, was found to be infested with Ixodids only, while the other, which was shot at 10 a.m., bore a few Ixodids and also 42 individuals of *Ornithodoros moubata*, Murr., which like other Argasids is seldom found on the host during the day

[*cf. R.A.E.*, B **4** 44]. The ticks were not attached to the skin, but were crawling about freely, mainly on the nape of the neck and along the ridge of the back. It is thought probable that the wart-hog infested with *Ornithodoros* had just left its burrow, though no burrow was found within 200 yards. The locality is about ten miles from the nearest permanent dwellings, but there are temporary camps in the area every year for the grazing of sheep and goats. Wart-hogs are plentiful there.

Burtt (E. T.). **The Occurrence of the Tick Parasite *Ixodiphagus caucurtei*, du Buysson (Hymenoptera ; Chalcidoidea : Fam. Encyrtidae) in Great Britain.** —*Proc. R. ent. Soc. Lond.* (A) **18** pt. 4–6 pp. 28–29, 7 refs. London, 1943.

Four males and seven females of *Hunterellus hookeri*, How. (*Ixodiphagus caucurtei*, du Buysson) were bred from two out of 587 gorged nymphs of *Ixodes ricinus*, L., taken on sheep in Cumberland between 29th September and 1st October 1942. This is believed to be the first record of this Encyrtid from Great Britain. Notes are given on its world distribution and hosts.

Meyer (J. R.). **Tratamento de cães fortemente atacados por carrapatos.** [The Treatment of Dogs heavily infested by Ticks.]—*Biológico* **8** no. 4 pp. 101–104. São Paulo, 1942.

Dogs in towns in São Paulo are often heavily infested by *Rhipicephalus sanguineus*, Latr., and those in the country are attacked by species of *Amblyomma*. In the course of investigations on the effect of extracts of roots of timbo [*Lonchocarpus*] on other parasites [*R.A.E.*, B **29** 121], the author found them to be very toxic to ticks, and in subsequent experiments he evolved a treatment for infested dogs that gave 99·4 per cent. mortality in 24 hours. This was to clip the coat, wash the animal well with soap and water, and, while it was still wet, apply a mixture of alcohol and 1·5 per cent. by volume of a filtered extract of the root (4 per cent. rotenone content) prepared by extracting 5 lb. root in 1 gal. acetone for a few hours. In localities where ticks are common, dogs should be treated weekly.

Papers noticed by Title only.

Paine (R. W.). **An Introduction to the Mosquitoes of Fiji. Descriptive Notes on the commoner Species, their Breeding Places and Occurrence ; together with simplified Keys for distinguishing the Adults and Larvae of Fijian Mosquitoes. (Second Edition.)**—*Bull. Dep. Agric. Fiji* no. 22, 32 pp., 1 map, 3 pls., 14 refs. Suva, 1943.

Knowles (F. L.). **Growth Measurements of *Anopheles quadrimaculatus* Larvae.** —*Publ. Hlth Rep.* **58** no. 4 pp. 136–139, 1 fig., 3 refs. Washington, D.C., 1943.

Herms (W. B.). **Preparation for a Career as a Medical Entomologist.**—*J. econ. Ent.* **36** no. 1 pp. 18–22, 9 refs. Menasha, Wis., 1943.

Travis (B. V.) & Bradley (G. H.). **The Distribution of *Aëdes* Mosquito Eggs on Salt Marshes in Florida** [including a Method of Sampling].—*J. econ. Ent.* **36** no. 1 pp. 45–50. Menasha, Wis., 1943. [*Cf. R.A.E.*, B **30** 190.]

Travis (B. V.). **Further Tests with Thallium Baits for Control of the Fire Ant** [*Solenopsis geminata*, F., in Florida].—*J. econ. Ent.* **36** no. 1 pp. 56–58, 4 refs. Menasha, Wis., 1943. [See *R.A.E.*, A **31** 395.]

De Meillon (B.). **Remarks on the Entomology of Malaria in the Tropics and Sub-tropics of Africa.**—*Prim. Congr. med. Lourenço Marques 1938* **3** pp. 63–74, 9 refs. Lourenço Marques, 1941. [Recd. 1943.]

In connection with the important part played by *Anopheles gambiae*, Giles, and *A. funestus*, Giles, in the transmission of malaria in tropical and sub-tropical Africa and the insignificance of other species, it is concluded that the importance as a vector of any species of *Anopheles* depends on its readiness to feed on man, as malaria parasites will develop in almost all of them. The manner in which the mosquitos locate their preferred hosts is discussed, and an account is given of experiments and observations made in various parts of the world that show the use of animal deviation to be valueless. Features for distinguishing the adults of *A. gambiae* and *A. funestus* are given, and their breeding places, adult habits, distribution as affected by climatic factors and relation to malaria are discussed, the section on breeding places of *A. gambiae* including notes on the effect of rainfall, vegetation and the activities of man. The programme of control based on drainage and clearing against *A. funestus* and subsequent continuous oiling against *A. gambiae* involves great expense, particularly as the half-mile radius for the control zone is inadequate [*R.A.E.*, B **28** 166; but *cf.* **30** 95], and Paris green dust is recommended, as it is easily applied and does not necessitate the removal of vegetation and consequent encouragement of breeding by *A. gambiae*. In Northern Rhodesia, the author found that where no drainage or disturbance of surface vegetation had taken place, *A. gambiae* comprised only about 3 per cent. of the Anophelines in dwellings, the rest being *A. funestus*, whereas the two species were taken in approximately equal numbers in controlled areas. The effectiveness of Paris green dust during rains is not known, but even oiling is rendered less effective by heavy rainfall. Spraying for the control of adult mosquitos in houses is considered useful only in special circumstances. On a mine in Northern Rhodesia, a rigorous campaign reduced the number of mosquitos to one in every ten huts, but did not apparently reduce the incidence of the disease.

Hopkins (G. H. E.). **Cotton-seed Tar as a Larvicide.**—*E. Afr. med. J.* **20** no. 2 pp. 41–45. Nairobi, 1943.

Experiments on the control of Anopheline larvae in Uganda with a mixture of three parts cotton-seed tar and one part kerosene [*cf. R.A.E.*, B **24** 273; **31** 90] were continued in 1941 on an estate where large numbers of *Anopheles gambiae*, Giles, and smaller numbers of other Anophelines were breeding in small drainage ditches. Its application was begun in July, and by the end of September, a sufficient area was being regularly treated to justify a survey. Anopheline larvae were found in 29 out of 49 untreated breeding places, and in only one out of 28 treated ones. This one exception might have been due to inefficient spraying. All the treated places were suitable for breeding, whereas at least ten of the untreated ones probably were not. *Culex* larvae were found in 11 of the treated breeding places, but they were almost all *C. consimilis*, Newst., a species of little or no medical importance, the larvae of which live in tangles of submerged thread-like green algae and probably obtain much of their oxygen from the bubbles in these tangles. The pupae are not similarly protected. In August 1942, when the whole area had been under control for about ten months, no Anopheline larvae were found in breeding places that had been treated one or two days previously. Those to which the mixture had been applied 5–6 days before contained a few larvae of *A. gambiae*. They were treated, and no larvae were found in them on the following day. Searches for adult Anophelines in staff-quarters and labour-lines yielded 119 individuals in July 1941, 75 in September 1941, 34 of which were from a camp remote from the treated area, and 3 in August 1942. If the mixture was filtered in accordance with instructions, it did not choke the sprayer. A mixture formed by

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thoroughly stirring handfuls of coffee parchment [husks of coffee beans] into the cotton-seed tar and kerosene, produced a good film when thrown violently on to the surface of the water, and also penetrated between grass stems, where spraying was ineffective.

BECKER (B. J. P.). **A preliminary Report on " Habaswein Itch."**—*E. Afr. med. J.* **20** no. 2 pp. 49–51. Nairobi, 1943.

An account is given of the etiology and symptoms of Habaswein itch, a widely prevalent and severe irritative skin condition thought to be peculiar to the Habaswein section of the Northern Frontier District of Kenya. Experiments are described as a result of which it concluded that the condition is attributable to the local and general toxic effects of the shed hairs of six kinds of Lepidopterous larvae. It is thought that these minute hairs could easily be spread by wind to bed linen, towels, etc., and in this way affect areas of the body that are not usually exposed.

ALLEN (T. C.), DICKE (R. J.) & BROOKS (J. W.). **Rapid Insecticide Testing. Use of the Settling Mist Method for testing of vaporized Contact Insecticides against Houseflies.**—*Soap* **19** no. 4 pp. 94–96, 121, 2 figs., 3 diagrs., 3 refs. New York, N.Y., 1943.

The duration is given of the development of the various stages of house-flies [*Musca domestica*, L.] reared at 85°F. and 60–70 per cent. relative humidity by a method that is described. Adults in gauze breeding cages were fed on milk and water from an inverted beaker resting on blotting paper and a watch glass, and measured quantities of the eggs laid were transferred to Richardson's medium [*R.A.E.*, B **20** 261]. Larvae were separated from the medium one day before pupation by placing it in a funnel fitted with screens of 4-, 8- and 12-mesh gauze and exposing it to light, which caused the larvae to work their way downwards through the screens into a receptacle containing dry sand. The pupae were removed from this by sifting over 12-mesh gauze. Only those that pupated within 24 hours were used, to ensure uniform emergence. About 24 hours before emergence was expected, the pupae were confined in testing cages of metal and 14-mesh gauze in which arrangement was made for the automatic supply of milk and water before use and sugar solution afterwards, on a wick of rolled cotton-wool. During testing, the cotton-wool was replaced by a cork.

To test the relative toxicities of contact insecticides by a settling mist method [*cf.* **27** 18], five-day old flies were placed, within these cages, in bell jars into the upper opening of which the spray had been introduced 10 seconds previously with a De Vilbiss atomiser. An exhaust fan below the cage was operated after two minutes to draw the mist from the chamber and volatilise excess spray. Knockdown was recorded after three and ten minutes, and separate counts of dead and moribund flies were made over a period of two days. Ten tests of each unknown in as many series gave the best average results. Comparative tests of plant-extractives in kerosene solution by this method and the Peet-Grady procedure [**16** 255] indicated that the settling mist method has a wide range of evaluation and a sharp degree of differentiation, and is sensitive to knockdown evaluations. It requires little labour, time or space, and the equipment is inexpensive.

GERTLER (S. I.), FALES (J. H.) & HALLER (H. L.). **Fly Spray Kill. A Study of the synergistic Action of N-substituted Piperonylamides when incorporated in Pyrethrum Fly Sprays.**—*Soap* **19** no. 4 pp. 105, 107, 4 refs. New York, N.Y., 1943.

As sesamin, which is considered to be responsible for the synergistic action of sesame oil on pyrethrum fly sprays [*cf. R.A.E.*, B **31** 8], occurs in sesame oil to

the extent of only 0·25 per cent. and cannot be economically synthesised, the synergistic effects of simple derivatives of it were tested. The methylenedioxyphenyl group was first combined with the N-isobutyl-carbamyl group, which occurs in one of the synthetic synergists available commercially. A combination of these two groupings is found in fagaramid (N-isobutyl-3, 4-methylenedioxycinnamamide), a constituent of *Fagara xanthoxyloides* (commonly called artar root). In preliminary tests against house-flies [*Musca domestica*, L.] by the turntable method [**26** 246], a solution containing 0·5 mg. total pyrethrins and 2·0 mg. synthetic fagaramid per cc. killed about as many flies as one containing 1 mg. pyrethrins. As it seemed desirable to determine the effect of simple compounds closely related to fagaramid, a series of N-substituted piperonylic acid amides, a list of which is given, was tested and the results evaluated statistically. A mixture of 90 per cent. deodorised kerosene and 10 per cent. acetone by volume was used, and the substance to be tested was added at 10 or 2 mg. per cc. according to solubility, or if neither of these concentrations was possible, a saturated solution was used. For each compound, a solution of the same concentration containing in addition 0·5 mg. pyrethrins per cc. was also tested. Three N-alkyl-substituted derivatives, used alone at 10 mg. per cc. caused mortality equal to that produced by the standard pyrethrum solution and these compounds and six others showed synergistic effect. The limiting factor appeared to be solubility. Kill was usually good when 10 mg. per cc. could be dissolved, but there was no rapid paralytic or knockdown action. The di-substituted aliphatic amides are usually liquids and are more soluble than the solid amides. The aromatic-substituted piperonylamides, however, also showed some synergistic action, although the concentrations were usually low. The ortho-substituted aromatic amides appeared to be more effective than the corresponding meta or para derivatives.

Richards jr. (A. G.). **The interfibrillar Material in the central Nervous System of Mosquito Larvae** (*Culex pipiens*).—*Biol. Bull.* **83** no. 2 p. 300. Lancaster, Pa., 1942. **Lipid Nerve Sheaths in Insects and their probable Relation to Insecticide Action.**—*J. N. Y. ent. Soc.* **51** no. 1 pp. 55–65, 2 pls., 33 refs. Lancaster, Pa., 1943.

It was shown in previous work on larvae of *Culex pipiens*, L. [*R.A.E.*, B **30** 124] that toxic petroleum oils cause a degeneration that seems largely a separation of the individual nerve cells and their processes, and in studies on the action of toxic oils, reported in the first paper, it was observed that oil solvents marked with Sudan dyes penetrated electively into the nervous system from tracheae. Correlation of these data resulted in the hypothesis that insect nerve cells and their processes are surrounded and insulated by some lipid material. This was confirmed in the investigations described in the second paper, in which the insects examined, in addition to the mosquito larva, comprised *Gryllulus* (*Gryllus*) *assimilis*, F., *Phymata erosa*, L., *Harpalus* sp., *Bombus* sp. and *Eristalis tenax*, L. They showed that insect nerve cells and their processes are surrounded by bound lipid sheaths of submicroscopic thickness, and solubility data suggested that the lipids are phospholipids, perhaps with the addition of cholesterol. The lipid nerve sheaths are correlated with and so probably condition the penetration of oil solvents such as xylol into the nervous system from tracheae. Presumably this finding will apply also to the penetration of toxic oils and oil-borne toxins, such as pyrethrins, the neurotoxic action of either of which appears to involve the destruction of the lipid nerve sheaths. Sheath degeneration also occurs as a relatively early post-mortem change in asphyxiated mosquito larvae, but it is not known whether it is directly concerned in the production of paralysis and death. Some aspects of the relation of these data to the study of insecticide physiology are discussed.

DAVID (W. A. L.). **Delousing of Clothing by Fumigation.**—*Brit. med. J.* no. 4307 p. 108. London, 1943.

To find a safe alternative for hydrocyanic acid gas against lice [*Pediculus humanus*, L.] in clothing, seven fumigants were tested, and three of them, methyl formate, ethyl formate and methallyl chloride, were found most suitable. Methallyl chloride is more expensive and more toxic to man than the formates, which are only very slightly toxic ; all three are inflammable. When infested clothing was fumigated in an ordinary ash-bin, 2 ft. high and $1\frac{1}{2}$ ft. in diameter, complete mortality of all stages, including the eggs, was given in 1, 2 and 5 hours by methyl formate at 38, 27 and 19 cc. per cu. ft. at 10°C. [50°F.] and at 30, 22 and 14 cc. at 20°C. [68°F.], by ethyl formate at 30, 24 and 11 cc. at 10°C. and 24, 19 and 8 cc. at 20°C., and by methallyl chloride at 41, 33 and 8 cc. at 10°C. and 19, 8 and 6 cc. at 20°C.

The treatment can be applied in any fairly air-tight tin box, chest or trunk. The garments are placed in one by one, packed tightly if necessary, and a little of the fumigant sprinkled on each or every other garment so that it is evenly dispersed throughout the mass, with rather more than half the volume in the upper part of the container, since the vapour sinks to the bottom. A small bottle with a metal screw cap in which a few holes have been punctured provides a satisfactory sprinkler. The container is kept closed for the prescribed period, and the garments then removed and shaken out to assist airing, which is usually complete in about 10 minutes. For prevailing temperatures of 10–20°C. the 10° dose should be used, and for temperatures above 20°C., the 20° dose.

GRINNELL (M. E.) & HAWES (I. L.). **Bibliography on Lice and Man with particular Reference to Wartime Conditions.**—*Bibliogr. Bull. U.S. Dep. Agric.* no. 1, v+106 pp. Washington, D.C., 1943.

This annotated bibliography of 961 references covers the literature on the two subspecies of *Pediculus humanus*, L., and on *Phthirus pubis*, L., published since 1917, when Nuttall's bibliography [*R.A.E.*, B **6** 18] appeared, and also contains some of the more important references from the latter. The annotations refer chiefly to control methods. The arrangement is chronological by years and alphabetically by authors under them, and an index to subjects as well as to authors is appended.

PEREIRA BARRETO [BARRETTO] (M.). **Morfologia dos ovos, larvas e pupas de alguns flebotomos de São Paulo.** [Morphology of the Eggs, Larvae and Pupae of some Species of *Phlebotomus* of São Paulo.]—*An. Fac. Med. Univ. S. Paulo* **17** pt. 2 pp. 357-427, 52 pls., 28 refs. São Paulo, 1941. (With a Summary in English.) [Recd. 1943.]

The author gives general descriptions of the eggs, larvae and pupae of *Phlebotomus* and detailed ones of those of *P. intermedius*, Lutz & Neiva, *P. fischeri*, Pinto, *P. migonei*, França, *P. monticolus*, Costa Lima, *P. limai*, Fonseca, *P. alphabeticus*, Fonseca, *P. arthuri*, Fonseca, *P. pestanai*, Barretto & Coutinho, *P. lanei*, Barretto & Coutinho, and *P. guimaraesi*, Coutinho & Barretto, from São Paulo. The immature stages of *P. whitmani*, Antunes & Coutinho, and *P. pessoai*, Coutinho & Barretto, cannot be distinguished from those of *P. intermedius* and *P. fischeri*, respectively. In general, the differences between the eggs of the various species are slight, but those between the larvae and the pupae are marked. Keys to the larvae and pupae are appended.

Savino (E.) & Riesel (M. A.). **Casos de peste en la provincia de Jujuy.** [Cases of Plague in the Province of Jujuy.]—*Bol. sanit. Dep. nac. Hig. Argent.* **6** no. 7–9 pp. 375–389, 14 figs., 2 maps. Buenos Aires, 1942.

Four cases of plague in man are described from La Esperanza and four from Agua Salada, in the province of Jujuy, Argentina. Rodents were trapped in both localities and fleas collected from them at La Esperanza. They comprised *Xenopsylla cheopis*, Roths., on *Mus* (*Rattus*) *rattus alexandrinus* and *M.* (*R.*) *norvegicus*, and *Rhopalopsyllus byturus*, J. & R., on *Holochilus balnearum* and *Galea musteloides*. *R. byturus*, with one example of *Craneopsylla minerva*, Roths., was also found on an opossum (*Marmosa*). The rats had a *cheopis* index of 4. None of the rodents or fleas examined was infected with plague, with the exception of one example of *G. musteloides*, of which the bone marrow proved infective, and there was no evidence of rodent plague at Agua Salada.

Toranzos (L. B.), Figuerero (M.) & Barbará (L.). **Primer caso agudo de enfermedad de Chagas en el departamento Mercedes (Provincia de Corrientes).** [The first acute Case of Chagas' Disease in the Department of Mercedes, Province of Corrientes.]—*Bol. sanit. Dep. nac. Hig. Argent.* **6** no. 7–9 pp. 469–473, 2 figs., 1 graph. Buenos Aires, 1942.

The case of Chagas' disease described occurred in a dwelling strongly infested with *Triatoma infestans*, Klug, and metacyclic and crithidial forms of *Trypanosoma* (*Schizotrypanum*) *cruzi* were found in the dejecta of 3 out of 15 examples of this bug.

Mazzotti (L.) & León (L. A.). **Infección experimental por** *Trypanosoma cruzi* **de** *Triatoma carrioni* **del Ecuador.** [Experimental Infection of *T. carrioni* with *Trypanosoma cruzi*.]—*Medicina* **22** no. 411 pp. 191–193, 1 fig., 4 refs. Mexico, D. F., 1942.

Of 19 examples of *Triatoma carrioni*, Larr., taken in southern Ecuador in 1941, none was found naturally infected with *Trypanosoma cruzi*. Most of them refused to feed and died, but two nymphs were fed on a healthy animal for two months, and on 5th January 1942 one of them was fed on a mouse that had been infected with *T. cruzi* and showed a few trypanosomes in the blood. On 9th February, developmental forms of *T. cruzi* were found in the dejecta of this nymph. The inhabitants state that the adults of *Triatoma carrioni* fly into houses by night, attracted by light, but as nymphs have also been found in dwellings, the adults presumably continue breeding indoors even if they do come from outside.

Mazzotti (L.). **Estudios sobre** *Triatoma hegneri*. **I. Infección natural y experimental con** *Trypanosoma cruzi*. **II. Intentos de cruzamiento con** *T. dimidiata*. [Studies on *T. hegneri*. I. Natural and experimental Infection with *T. cruzi*. II. Attempts at Crossing with *T. dimidiata*.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 1 pp. 53–56, 1 fig., 3 refs. Mexico, D. F., 1943. (With a Summary in English.)

Triatoma hegneri, Mazzotti, was described from examples taken in 1939 in an ancient ruin on Cozumel Island, Yucatan [*R.A.E.*, B **28** 200], and one of the five adults collected proved to be infected with *Trypanosoma cruzi*. It is a rare species, for in 1942 it could not be found anywhere on the island except in the same ruin ; 12 nymphs and one adult were taken there, and one of the nymphs was shown to be naturally infected with the trypanosome. Of six of the other nymphs placed on an infected mouse, two fed and both acquired

the infection. *Triatoma hegneri* somewhat resembles *T. dimidiata*, Latr., which is common on the mainland of Yucatan, and attempts were therefore made to cross them, but of three females of the former kept with males of the latter, two laid eggs that did not hatch and the other failed to oviposit.

Vargas (L.). **Los subgéneros americanos de** *Anopheles* **(Diptera, Culicidae)** *Anopheles (Russellia) xelajuensis* **De León, 1938 n. subgn. y** *Anopheles (Coelodiazesis) fausti* **n. sp.** [The American Subgenera of *Anopheles*, *Anopheles (Russellia) xelajuensis* De León, 1938 n. subgn., and *Anopheles (Coelodiazesis) fausti*, sp. n.]—*Rev. Inst. Salub. Enferm. trop.* **4** no. 1 pp. 57–72, 5 pls., 20 refs. Mexico, D. F., 1943. (With a Summary in English.)

The author recognises nine American subgenera of *Anopheles*, states that larval characters are useful for distinguishing them and gives keys to them based on the larvae, pupae, adults and male terminalia. He discusses the status of *Coelodiazesis*, which he considers a valid subgenus, and places in it *A. (C.) fausti*, sp. n., the larva of which he erroneously described in 1942 as that of *A. xelajuensis*, De León [*R.A.E.*, B **31** 51]. He describes the female of *A. fausti* and states that larvae, larval exuviae, males and females were found in April and May in tree-holes in San Luis Potosí, Mexico. He erects a new subgenus, *Russellia*, for *A. xelajuensis*, and describes the larva, pupa and adults of this species. The larvae were taken in September in tree-holes in Oaxaca, at 8,000–8,500 ft. The pupal stage lasted 12–15 days, and the resulting females fed readily on man. The larvae feed on the sediment at the bottom of the water and seldom rise to the surface.

Lewis (D. J.). **The Destruction of Mosquito Larvae by Terrapins.**—*Sudan Notes* **25** pt. 1 p. 141. Khartoum, 1942.

In the course of a mosquito survey during the epidemic of yellow fever in 1940 in the Nuba mountains [*cf. R.A.E.*, B **29** 115], the author examined numbers of domestic water jars. In two villages near Talodi he found that 25 per cent. of the jars each contained one or two small water-tortoises (*Pelomedusa galeata*) and no mosquito larvae. If the tortoises were given mosquito larvae they fed voraciously on them, and larvae of *Aëdes aegypti*, L., were found in several of the jars that did not contain a tortoise. These two villages were among the few in which *A. aegypti* was common in the dry season (November), the reason being that water is stored for long periods in unusually large jars, and they are near the area where the epidemic is thought to have started.

Soper (F. L.) & Wilson (D. B.). **Species Eradication. A practical Goal of Species Reduction in the Control of Mosquito-borne Disease.**—*J. nat. Malar. Soc.* [**1**] pp. 5–24, 1 map, 13 refs. Tallahassee, Fla., 1942.

Accounts are given of campaigns as a result of which *Anopheles gambiae*, Giles, has apparently been eliminated from Brazil and *Aëdes aegypti*, L., from many of the larger cities and even entire States. Records of the early stages and subsequent development of the campaign against *A. aegypti* have already been noticed [*R.A.E.*, B **26** 42 ; **28** 18]. The numbers of houses with foci of this mosquito in each of 21 Brazilian ports in the four quarters of one year between 1931 and 1936, before the eradication programme was begun, and in each quarter from January 1938 to September 1941 are shown in a table. The total number of houses in the ports was about 784,507 ; the total numbers of foci were 141,247 in a pre-eradication year and 32, 10, 20 and 6 in 1938, 1939, 1940 and the first 9 months of 1941, respectively. No foci were found in or after 1938 in 11 of the ports. When infestations were located by examination of

breeding places only, empty houses constituted a serious problem. The introduction of the capture of adults as an indication of infestation made it unnecessary to examine empty houses unless adults were caught in neighbouring houses. The first zero indices were obtained in 1932. Reinfestation of cities that were apparently free from *A. aegypti* was often due to putting water into jars that had been dry for several months and on the sides of which were viable eggs. Such internal reinfestation ceased after a time, but threat of reinfestation from without often made it necessary to extend measures. Such extension without increased expenditure was made possible by the suspension of routine inspection of breeding places in cleared areas [**28** 18] where the capture of adults proved to be an adequate indicator of reinfestation. Search for adults, which is slow and expensive, is not used until the population is becoming low. The administrative and psychological advantages of eradication are pointed out. Areas from which *A. aegypti* has been eradicated have been protected from serious reinfestation for years at a time for a small part of the expense previously incurred in maintaining safe indices in a few of the larger cities. Eradication of *A. aegypti* from the whole of Brazil is now being aimed at.

Anopheles gambiae was controlled in Natal, the city in which it first occurred [**20** 171 ; **27** 125] by a campaign carried out in 1931, but it was neglected elsewhere and spread widely in Rio Grande do Norte and particularly in Ceará [**28** 194 ; **29** 58], causing severe epidemic malaria. Operations were begun after the rainy season of 1939 had set in, but the first six months' work was discouraging, and *A. gambiae* continued to spread up the Jaguaribe and its tributaries. However, in the second half of the year, simplified methods of applying Paris green, both wet and dry, were adopted [*cf.* **28** 195], anti-larval work was reinforced by the use of pyrethrum sprays [**29** 114], and hand capture of adults as an indication of distribution was replaced by the flit-umbrella method [**26** 179]. Before the end of the year, *A. gambiae* had apparently been eradicated from certain districts and its dissemination successfully blocked at most points. The area in which infestation could be found continued to diminish through the rainy season in 1940, while exceptionally high densities were registered in two uncontrolled areas. During the year, it was found safe to discontinue control measures in any district after the mosquito had not been found there for three months. No evidence of infestation was found anywhere after 14th November 1940, and all measures in Brazil were suspended in January 1941.

Sweet (W. C.), Feng (L. C.), Chow (C. Y.) & Hsu (S. C.). **Anophelines of southwestern Yunnan and their Relation to Malaria.**—*J. nat. Malar. Soc.* [**1**] pp. 25–32, 9 refs. Tallahassee, Fla., 1942.

A brief report is made on the temperature, humidity and rainfall of the Chefang Valley in Yunnan Province, China, and a list is given of the 21 species or varieties of *Anopheles* taken in the course of work at the laboratory established there in March 1940 under the Rockefeller Foundation for the investigation of malaria on the China-Burma highway. These included, in addition to most of those recorded in previous lists [*R.A.E.*, B **25** 99 ; **28** 156 ; **29** 95], *A. aconitus*, Dön., *A. annandalei* var. *interruptus*, Puri, *A. leucosphyrus*, Dön., *A. subpictus*, Grassi, and probably *A. fluviatilis*, James. Gradations between forms identified as *A. fluviatilis* and *A. minimus*, Theo., were so numerous that it is not possible to be sure of the presence of the former. In 26,372 dissections of females of 13 species, including 18,707 of *A. minimus*, 6,152 of *A. hyrcanus* var. *sinensis*, Wied., and 180 identified as *A. fluviatilis*, infection was found only in *A. minimus*. Of this species, 127 females were positive for oöcysts and 54 for sporozoites, or 164 in all, giving an infection rate for the whole Chefang Valley of 0·9 per cent. Infections were found in all months except December, January and February. The infection rates were 1·7 per cent. in the village of Chefang

and 0·6 per cent. in smaller outlying villages. They were 0·5 and 1·0 per cent. in females caught in buildings or parts of buildings housing domestic animals and man, respectively. Human habitations yielded 68·7, 16·1 and 55·9 per cent., respectively, of the total catches of *A. minimus*, *A. h. sinensis* and other species. Larvae of *A. minimus* were almost limited to ditches, irrigation channels and streams of swiftly moving fresh water. They were extremely rare in rice-fields.

RENN (C. E.). **The crushing Strength of Biological Films on natural Waters and the Spread of larvicidal Oils.**—*J. nat. Malar. Soc.* [**1**] pp. 45–55, 2 figs., 4 refs. Tallahassee, Fla., 1942.

The ability of an oil to spread over the surface of clean water depends on the forces existing at three interfaces, its spreading coefficient (dynes/cm.) being the difference between the air-water interfacial tension and the sum of the air-oil and oil-water interfacial tensions. When, however, films consisting of bacteria, protozoa, algae, pollen, dusts and microscopic débris imbedded in a tough, inelastic bacterial slime form on undisturbed natural waters, they retard the spread of oils applied for the control of mosquito larvae. In clean water, equivalent lines of tension extend in all directions over the interface from every point, but when fine particulate materials become embedded in the interface or when the surface is covered with inelastic bacterial slimes, cell stuff or fine flotage, the effective pull along these lines and the spreading coefficients of oils on the water are diminished by an amount equal to the crushing strength (dynes/cm.) of the biological coating. This is of much greater importance on polluted waters than on the relatively clean ones in which Anophelines breed, and it is shown from observations on Anopheline breeding places in 1940 that the spreading of oils is most strikingly retarded when winds compress accumulated films against them at the leeward margins of ponds. Very light winds can do this. To ensure the effective spread of larvicidal oils on coated waters, the film must be destroyed by agitating the surface. In tests on one of the reservoirs of the Tennessee Valley Authority, oils that would not spread to any extent when applied alone readily formed films when applied in water as a heavy spray over areas that had resistant coatings. Only a light whipping of the surface by the droplets was necessary to break up the film. It is desirable that portable apparatus should be developed for treating protected areas that have now to be oiled by hand. Films on quiet waters, inaccessible to the wind, usually have a low crushing strength, and oils with a spreading coefficient of more than 5 dynes/cm. can spread on them, but the film fragments swept aside by the oil film may accumulate at the margins of the pond in streaks, rafts and islands about flotage or emergent vegetation. No larvae were found in these sites, and it is thought that Anophelines do not develop in waters coated by thick, standing films.

ANDREWS (J.), HOWARD jr. (R. S.) & TURNER (E. A.). **Malaria-control, Ditch-lining Experience in a south Georgia County.**—*J. nat. Malar. Soc.* [**1**] pp. 57–67, 1 map, 6 figs., 1 ref. Tallahassee, Fla., 1942.

The construction and installation of 21,814 ft. of pre-cast concrete inverts of various types with accessory structures in ditches in a small town in southern Georgia to prevent the breeding of *Anopheles quadrimaculatus*, Say, are discussed, with particular reference to cost. About 73 per cent. of the expenditure was for labour. Surveys in 1938 and 1939 had indicated that the only significant breeding was taking place in the numerous open ditches, which were silted and clogged with vegetation. The ditch-lining had barely been begun in the malaria season of 1940 and only 60–65 per cent. of it was completed in the malaria season of 1941. Cases of malaria occurring in the town constituted 37, 43, 40

and 21 per cent. of those occurring in the surrounding county in 1938, 1939, 1940 and the first ten months of 1941, respectively. Inverts, parabolic in section, cast against special forms and having lap-joints cost more than inverts cast against pipe and having butt-joints and did not appear more satisfactory, except in articulation design. Lap-joints were definitely superior to butt-joints, as vegetation tended to grow in the interstices of the latter, whereas it rarely, if ever, grew through a lap-joint [*cf. R.A.E.*, B **30** 168]. The flow did not appear to be any better in ditches lined with parabolic invert sections than in those lined with arc-shaped sections.

LEGWEN (W. A.) & LENERT (L. G.). **Circular Joint and Concrete Form Design for Precast Inverts for Malaria-control Ditch-lining.**—*J. nat. Malar. Soc.* [**1**] pp. 69–82, 31 figs., 2 refs. Tallahassee, Fla., 1942.

Descriptions are given of two types of circular joints for pre-cast invert slabs for lining ditches to control Anopheline breeding. With these joints and variable slab widths, inverts of practically any section can be constructed. Particulars are also given of the casting of cement mortar or concrete forms on the site. The use of these forms, which are bound together with a wedging system requiring no repetitive nailing or bolting, and the restriction of the width of slabs to a maximum of 18 inches, so that they can be placed by one man, greatly reduce costs.

LEGWEN (W. A.) & HOWARD jr. (R. S.). **The Design and Application of a new Type Automatic Siphon for Malaria Control.**—*J. nat. Malar. Soc.* [**1**] pp. 83–92, 11 figs., 10 refs. Tallahassee, Fla., 1942.

The Macdonald siphon [*R.A.E.*, B **27** 207] is considered the best of those designed to flush streams for Anopheline control, but [like others (**29** 169 ; **31** 14, 97)] it has a small subsidiary siphon to suck the compressed air out of the main one. This involves a waste of water and a risk, if there is very little flow, that an equilibrium may be established between the inflow and waste water discharged so that the main siphon will not operate. A siphon that avoids this difficulty was therefore designed to effect fluctuation in the level of lakes, as well as to flush streams and ditches, for the control of *Anopheles quadrimaculatus*, Say, in the United States. The compressed air is released through a $\frac{1}{4}$-inch U tube of which one end enters the lower limb of the siphon above the sealing basin and the other opens at water level in the basin. The bottom of the U is a little higher than the bottom of the lower limb of the siphon. Air to terminate siphonage is admitted through a tube that passes into the upper limb of the siphon and then upwards almost to its top. The distance from the top of the siphon to the top of the weir within it is slightly less than the distance from the surface of the water in the sealing basin to the bottom of the U tube. Consequently, when the reservoir fills to the level of the top of the siphon, the air is released through the U tube and siphonage starts. A mathematical formula for designing or checking a siphon of this type is given.

A change in water level of about a foot within the time required for the mosquito to complete development gives effective control in reservoirs, etc. [**24** 131]. The rate of rise in water level and the capacity of the siphon must therefore both be sufficient for the process to be completed in the required time. If two or more siphons are installed in a single dam to furnish greater discharge, they must be connected with a common venting system.

GOODWIN jr. (M. H.). **Studies on artificial Resting Places of** *Anopheles quadrimaculatus* **Say.**—*J. nat. Malar. Soc.* [**1**] pp. 93–99, 5 refs. Tallahassee, Fla., 1942.

The comparative value of data from collections of Anophelines made in natural and artificial resting places is briefly discussed. The latter have the

advantage of being comparable from place to place. The best one so far devised for *Anopheles quadrimaculatus*, Say, appears to be the keg shelter [*R.A.E.*, B **31** 52], but resting places of this type installed in southern Georgia were not sufficiently attractive to furnish reliable data. In an attempt to adapt the design to give better results under local conditions, black, white or coloured pine-wood boxes of various sizes and shapes with one side open were compared. They were placed in the shade near breeding places, on the ground, against trees or on shelves. Counts were usually made daily, but there was no evidence of day-to-day accumulation in catches made at longer intervals. No useful purpose was served by making boxes more than 2 ft. long or 1 sq. ft. in cross section, and such large boxes were cumbersome to handle. The best results were obtained with a red cubical box with a side 12 inches long. Single boxes seemed equally attractive at any height within 6 feet of the ground, but when vertical tiers of boxes were available, those on or near the ground were preferred. The orientation of boxes with regard to breeding places or dwellings did not affect the catch, but boxes facing east regularly had lower counts than those facing other directions. When boxes were arranged in a horizontal row, those at the ends were preferred. Average counts from miscellaneous observations showed that red boxes were more attractive than black ones, both were more attractive than kegs, and all these artificial resting places were less attractive than natural shelters, such as outbuildings and hollow trees.

LUND (H. O.). **Studies on the Choice of a Medium for Oviposition by** *Anopheles quadrimaculatus* **Say.**—*J. nat. Malar. Soc.* [**1**] pp. 101–111, 2 figs., 2 refs. Tallahassee, Fla., 1942.

An account is given of experiments in Georgia in which females of *Anopheles quadrimaculatus*, Say, caught in nature were given the opportunity to oviposit in dishes containing various solutions and suspensions. In a dim light, the females chose dark rather than light containers in which to lay their eggs [*cf.* *R.A.E.*, B **28** 231], but they did not distinguish between the dishes in total darkness. There was no statistical evidence of any preference among samples of water differing in hardness, concentration of calcium ions, muddiness, presence or absence of algae, salinity, content of phosphorus, ammonia or tannic acid, pH, or presence or absence of ferric or aluminium chloride or sucrose. Sodium chloride, ammonium carbonate, tannic acid, ferric chloride and aluminium chloride were toxic to the eggs at concentrations that did not repel the ovipositing females.

KOMP (W. H. W.). **The Anopheline Mosquitoes of the Caribbean Region.**—*Bull. nat. Inst. Hlth* no. 179, ix+195 pp., 155 figs., 44 refs. Washington, D.C., Supdt. Documents, 1942. Price 35 *cts.*

This exposition of present knowledge on the Anophelines of the Caribbean Region is based both on the literature and on the author's own observations. The Region is restricted to the islands and coastal lowlands of the mainland that border on the Caribbean Sea. There are very short sections on geographical distribution and on the susceptibility of Caribbean species of *Anopheles* to infection with malaria parasites and their importance as vectors of the disease. Apart from these, the paper is concerned exclusively with classification and identification. The classification used is adapted from that of Edwards [*R.A.E.*, B **21** 1], and the characters of all stages used in identification and classification are described, with notes on variability of larval characters, variations in wing markings and the value of leg and wing markings as differential characters. The author's reasons for regarding *Kerteszia* as a subgenus [**31** 113] are given. The classification of the one species of *Chagasia* (*bathanus*, Dyar) and 21 species of *Anopheles* known to occur in the region when the work was prepared is shown. Keys in English and Spanish are given to the males

(based on terminalia), females and larvae of these species and also a short key to the females of the 13 commonest ones and notes on the others. Short descriptions of the females of the 22 species, to assist preliminary identification by those unaccustomed to the use of keys, are followed by full descriptions of the females, larvae and male terminalia of each. Interlinear Spanish translations are given of the descriptions of *Anopheles albimanus*, Wied., and lists of the English, Spanish and Portuguese equivalents of certain entomological terms.

RUSSELL (P. F.), KNIPE (F. W.) & RAMANATHA RAO (H.). **On Agricultural Malaria and its Control with special Reference to South India.**—*Indian med. Gaz.* **77** no. 12 pp. 744–754, 31 refs. Calcutta, 1942.

In southern India, malaria retards agricultural development, forces the abandonment of fertile areas, affects organised tea, coffee and other plantations, prevents maximum development and exploitation of forest resources, complicates irrigation systems, increases as a result of the formation of breeding places for Anophelines by the farmers themselves, and occasions expense to impoverished ryots. In some areas, an inverse correlation exists between the amount of malaria and the intensity and extent of cultivation. The principal crops include rice, sugar-cane, betel-vine, banana, areca palm, turmeric and casuarina, which are sources of Anopheline production owing to the methods of cultivating them, tea, coffee, cardamom and rubber, which are associated with natural foot-hill malaria because of the type of country in which they grow best, and cotton and millets, which grow in naturally malarious flat areas.

It is shown that the relation of each rice-growing area to malaria production must be judged individually. The greatest rice-growing areas in southern India are not malarious, but rice-fields in Pattukkottai taluk play a significant part in maintaining endemic malaria through their large output of *Anopheles culicifacies*, Giles [*R.A.E.*, B **27** 44; **29** 147], whereas, in the neighbouring Tanjore delta, the rice-fields and channels are only potentially dangerous because this vector is found in comparatively small numbers there [**31** 170]. Some pertinent characteristics of Pattukkottai rice-fields [*cf.* **29** 147; **31** 62] and of those of the Nilgiris-Wynaad area [**28** 162] are discussed. In Gudalur and Kallar in the Nilgiris District, where bananas and areca palms are grown, the local vector, *A. fluviatilis*, James, breeds in the supply or drainage channels or in the depressions between rows of plants. This could easily be stopped by proper regulation of the water, providing for short drying periods. Most agricultural malaria in the foot-hills affects the tea, coffee and rubber estates. It originates in the natural foot-hill streams and is aggravated by clearing preparatory to planting. Casuarina-pit malaria is a problem in the Madras area [**28** 2, 94]. The bearing of the construction and maintenance of irrigation systems on malaria [**27** 152, etc.] and the cost of malaria to the ryot are discussed.

Among the control measures dealt with, spraying huts and outhouses with pyrethrum extract in the day-time to kill adult mosquitos [**30** 168, etc.] is considered the most promising. In a village that had been sprayed for three years and in which the spleen rate had been reduced from 68 per cent. in 1937 to 6 per cent. in 1940 and the parasite rate had fallen to 0 [**30** 169], no spraying was done in 1941 and the spleen and parasite rates rose to 17·0 and 15·3 per cent., respectively. In another village sprayed for the first time in 1940 and again in 1941 with extract of Indian-grown pyrethrum, which is much cheaper than imported extracts, the spleen rates in November in 1937, 1938, 1940 and 1941 were 80, 82, 28 and 6·3 per cent., respectively. A water-emulsion spray consisting of 1 gal. concentrated kerosene extract of Indian-grown pyrethrum emulsified with 184 gm. sodium lauryl sulphate in 7 gals. water gave excellent results in Pattukkottai in 1941, causing the spleen rate to fall from 48 per cent. in 1940 to 16 per cent.

Intermittent irrigation of rice-fields has also given promising results in Pattukkottai over an experimental period of four years [**31** 115]. Complete elimination of mosquito breeding places or even of those of the vector is shown to be impracticable. An account is given of experiments carried out over an area of 7 sq. miles and designed to demonstrate the method, cost and effect of reducing the larval population by correcting defects in irrigation, preventing wastage of water, and filling or draining pits and ditches. The measures included the filling of 700 large borrow-pits, usually by taking earth from high-level fields and so bringing 35½ acres of new rice land under cultivation, the cleaning and deepening of reservoirs, the formation of numerous new field supply channels, the installation of nine tight-fitting gates at sluice-heads and of improved devices for the control of water in field channels, and the introduction of *Gambusia* into 1,464 wells after chlorination to kill larger fish. Intermittent irrigation was practised in 1940 and 1941. The spleen rates in the malaria season in three of the villages in the treated area and a control village were 48, 54, 56 and 53 per cent. in 1937 and 4, 19, 11 and 57 per cent. in 1941, and the corresponding parasite rates were 42, 50, 49 and 43, and 0, 10, 3 and 48 per cent. Experiments showed Paris green applied with an automatic distributor [**31** 76] or sprayed in a water suspension [**29** 112] to be successful for the control of breeding along canals and channels. *Wolffia* was introduced into pools with some success, to exclude mosquito larvae, as they do not occur in water that is completely covered with it. The possibility of controlling malaria in Pattukkottai by intensifying and extending cultivation is discussed at some length, reasons being given for considering that this is practicable [*cf.* **31** 170].

SERGENT (Et.). **Paludisme chez l'oiseau** (*Plasmodium relictum*). **Infections sanguines provoquées par la piqûre d'un seul moustique ou de plusieurs moustiques du même lot.**—*Arch. Inst. Pasteur Algérie* **19** no. 1 pp. 34–36. Algiers, 1941. [Recd. 1943.]

As it was thought probable that the severity of malaria cases in the violent epidemics that occur when Anophelines are particularly abundant might be attributed to multiple infection by a large number of mosquitos, three experiments were made to ascertain whether infection with avian malaria caused by *Plasmodium praecox* (*relictum*) was more intense when transmitted by several mosquitos than when transmitted by one. In each experiment, one of two canaries that had been proved to be susceptible to infection by a method that is described was bitten by one infected female of *Culex*, while the other was bitten by nine or ten infected females of the same batch. In one experiment, the bird bitten by ten mosquitos developed a much heavier infection than the other and died; but in the other two, the bird bitten by only one mosquito developed the heavier infection, the difference in intensity being considerable in one case and slight in the other.

[ZHUKOV (N. M.) & KRASIKOVA (V. I.).] **Жуков (Н. М.) и Красикова (В. И.). The Division into Types of the Malaria Foci in the former Kuibyshev Region.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 487–493, 2 figs., 4 refs. Moscow, 1942.

Four years' investigations in the Province of Kuibyshev showed that the chief endemic foci of malaria are either villages in flooded localities along the rivers or villages on the slopes of ravines in which are small rivers fed by springs. Some localities included both these types, and there were also some foci of the flooded type in the steppe. The varieties of *Anopheles maculipennis*, Mg., found were *messeae*, Flni., and *typicus*. The former constituted 94·6 per cent. of the population in the flooded localities, where the larvae were very abundant

in the numerous lakes formed in the river valleys as the water receded in spring. They also occurred in ponds, ditches and swamps, and larvae of *typicus* in small rivers and water from springs. The adult mosquitos migrated to villages situated on the high bank of a river by flying across at places where it was little more than a mile wide, or by being carried over in boats. They concentrated chiefly in buildings near the river, and of the mosquitos taken in these, up to 36, 12 and 14 per cent. were infected in June, August and September, respectively. Precipitin tests showed that 42·1 per cent. of the females of *messeae* taken in cattle sheds and sometimes all those taken in inhabited houses contained human blood. Females in a state of gonotrophic dissociation were most numerous in May and September (35·2 and 28·2 per cent., respectively), which accounted for the frequent infections in houses. The adults entered hibernation quarters in the second half of August and in September, and were responsible for the transmission of malaria in autumn. The parasite indices of children were high in November–December and February–March.

In foci of the ravine types, the water surface was much smaller and there were fewer mosquitos. Up to the middle of July, neither variety predominated for long, but from then onward, the typical form was much the more numerous. There was only a negligible percentage of females (probably those of *messeae*) in a state of gonotrophic dissociation in August, and very little malaria due to them. The mosquitos developed their fat-body and entered hibernation some six weeks earlier than did *messeae* in the flooded districts and so the contact between *typicus* and man was broken earlier. Of the mosquitos taken in cattle sheds, only 5·2 per cent. contained human blood. The parasite and spleen indices were low. A slight rise in the incidence of malaria in spring and sometimes in autumn was due to introduced cases or the formation of swamps following the construction of weirs in the rivers, which resulted in the local prevalence of *messeae*. In foci of this type, cases of malaria were sometimes more frequent in houses some distance from the river or spring than in those close to them.

In malaria foci of the first type, the entire complex of control measures, medical and prophylactic, should be carried out. Larvicidal measures should be supplemented by the destruction of adult mosquitos in day-time shelters every third day in June, every other day in July, August and September, and daily in houses occupied by gametocyte carriers. In summer resorts and recreation camps, mosquito nets should be used and windows screened. In foci of the second type, precautions should be taken against the introduction of malaria, chiefly by those who have been engaged in hay-making in the low-lying flooded localities.

[Zavoĭskaya (V. K.).] **Завойская (В. К.). An Experiment on Malaria Eradication from Villages in Ravine-Spring Localities of the Syzran District, Kuibyshev Province.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 493–500, 1 graph. Moscow, 1942.

An account is given of work carried out in 1938 and 1939 on the control of *Anopheles maculipennis*, Mg., in six villages situated in localities characterised by ravines and springs on the middle Volga. Examination of the eggs obtained from captured females showed that the varieties present in all the villages were *typicus* and *messeae*, Flni. They fed chiefly on domestic animals and appeared to be of equal importance in the transmission of malaria, since 4 of 628 females of var. *messeae* and 2 of 146 of var. *typicus* taken in animal quarters contained oöcysts. The measures adopted in the villages are described, and it is concluded that in the villages situated among orchards or forests and having numerous accumulations of water, destruction of the mosquitos in day-time shelters, oiling against the larvae and medical treatment of the inhabitants are all necessary to reduce the incidence of malaria. In forest localities, the mosquitos

do not concentrate in the villages until August, when they are seeking hibernation quarters; the control of the larvae alone would, therefore, be sufficient, provided that the breeding places are accessible and not too numerous.

In villages situated in steppe localities devoid of orchards or forest, the destruction of adult mosquitos in shelters throughout the summer decreased the numbers of larvae and the incidence of the disease, except when there was an influx of mosquitos from flooded areas or from another village. In experiments in which batches of up to 4,000 stained mosquitos were released in the flooded area on the Volga, a few from almost every batch were later taken in a village nearly 3½ miles away.

[SHLENOVA (M. F.).] **Шленова (М. Ф.). The Places of Attack of malarial Mosquitoes on Inhabitants of Kuibyshev.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 501–509, 7 figs. Moscow, 1942.

[LUPPOVA (N. N.), VINOGRADOVA (I. V.) & SEMUSHKINA (T. V.).] **Луппова (Н. Н.), Виноградова (И. В.) и Семушкина (Т. В.). The Epidemiology and Control of Malaria in Cheboksary.** [*In Russian.*]—*T.c.* pp. 509–516, 1 map.

In these two papers, which are primarily of local interest, notes are given on the character of the districts in and near the towns of Kuibyshev and Cheboksarui on the Volga, the ways in which the inhabitants come into contact with *Anopheles maculipennis*, Mg., chiefly by frequenting places outside the towns in which it breeds, and the desirability of extending control measures to these places.

[SOLODOVNIKOVA (O.).] **Солодовникова (О.). Gamotropic Properties of Quinoline No. 31 in tropical Malaria.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 526–531. Moscow, 1942.

Since plasmocide [*cf. R.A.E.*, B **22** 38; **26** 72] has in some cases proved toxic to malaria patients, experiments were carried out in Samarkand in 1938 on the extent to which quinolin no. 31, another Russian synthetic drug, renders patients non-infective to Anophelines. Females of *Anopheles maculipennis* var. *sacharovi*, Favr, were allowed to feed before and 24 hours after administration of the drug on patients showing gametocytes of *Plasmodium falciparum* or *P. vivax* and *P. falciparum* in the peripheral blood and were then kept at 21–25°C. [69·8–77°F.] and 75–80 per cent. relative humidity, fed on sugar solution or guineapigs, and ultimately examined for oöcysts and sporozoites. The results showed that at a suitable dosage the drug considerably reduced the infectivity of the carriers of *P. falciparum* to the mosquitos, even after treatment for only one day, except when the numbers of gametocytes were extremely high, and also reduced the numbers of gametocytes in the peripheral blood or caused them to disappear entirely. It was much less effective in the cases of mixed infection.

[NIKULIN (I. N.).] **Никулин (И. Н.). On the Choice of antimalarial Measures.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 531–532. Moscow, 1942.

Investigations on malaria in three villages in the Province of Voroshilovgrad (eastern Ukraine) in 1936 revealed infection rates of 93, 99 and 72 per thousand of the population. Favourable breeding places for Anophelines were provided by swamps near rivers and by numerous lakes densely overgrown with aquatic vegetation. The usual medical treatment and measures against mosquitos and their larvae failed to reduce the number of cases or the abundance of the mosquitos in the villages. In 1937 and 1938, therefore, quinine prophylaxis was extended, swampy land was reclaimed and mosquitos systematically destroyed by collecting them in houses and spraying in animal quarters. As a result, the rates of infection dropped to 39·4, 30 and 26 in 1938, and 10·5, 13 and 2 in 1939.

It is concluded that where large expanses of water densely covered with vegetation are infested and the control of Anopheline larvae by drainage or dusting from aircraft is not feasible, daily destruction of the adult mosquitos in dwellings and animal quarters is more effective than measures against the larvae, and also that large swamps near a village can be dealt with more effectively by land reclamation than by larvicides.

[Lazebnuiĭ (N. V.).] **Лазебный (Н. В.). Mosquito Control in Day-time Resting Places.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 533–534. Moscow, 1942.

In 1938, housewives in Melitopol (southern Ukraine) and Dzhankoĭ (northern Crimea) undertook the regular destruction of Anophelines in houses as part of their normal cleaning operations. As a result, the percentage of infested houses decreased to 1·96 in Melitopol and 0·7 in Dzhankoĭ, as compared with 9 where no regular control was effected. The numbers of primary cases of malaria were reduced by 29·7 per cent. in Melitopol and by 67·2 per cent. in Dzhankoĭ, as compared with 1937, and there was only one peak, in June, instead of the usual two, in May and August.

It is concluded that the destruction of mosquitos in a village is better carried out by the inhabitants, who can do it daily, than by members of the local malaria station, who can only do it at intervals.

[Derbeneva-Ukhova (V. P.).] **Дербенева-Ухова (В. П.). On the Ecology of** ***Musca domestica*** **L. and** ***Muscina stabulans*** **Flln.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 534–543, 5 graphs, 7 refs. Moscow, 1942.

An account is given of observations on the breeding places and seasonal frequency of *Musca domestica*, L., and *Muscina stabulans*, Fall., in four adjacent villages on the Dvina, Province of Archangel, carried out from July to November 1940, and the results are compared with those recorded for these and other flies from the warmer regions of the Caucasus [*R.A.E.*, B **31** 124, 126]. In the absence of large accumulations of horse and pig dung, *Musca domestica* bred chiefly in calf dung, while larvae of *Muscina* occurred mostly in human faeces scattered about the villages, though not in latrines. Adults of the former were most numerous in houses and of the latter in animal quarters, and following the summer peak in the numbers of *Musca* in houses there was a second peak in autumn when heating began. In investigations on the spread of *Musca*, three batches of 1,000 stained flies were released in August in two calf byres and an empty cattle shed, and catches were made in traps in neighbouring buildings. The results showed that of those released in the byres, most stayed in them and the only ones recovered at a distance of more than 500 ft. were taken in a house adjoining a piggery some 1,300 ft. from the point of release. Flies released in the empty shed were recovered at distances of up to about 1,150 ft., most of them in houses close to the byres.

[Vladimirova (M. S.).] **Владимирова (М. С.). The Depth of the Pupation of** ***Phormia groenlandica*** **Zett. and** ***Calliphora erythrocephala*** **Mg.** [*In Russian.*] —*Med. Parasitol.* **10** no. 5–6 pp. 543–548, 3 graphs, 6 refs. Moscow, 1942.

In laboratory experiments in Moscow, larvae of *Phormia terraenovae*, R.-D. (*groenlandica*, Zett.) and *Calliphora erythrocephala*, Mg., together with the medium in which they developed, were placed in glass containers on sand compressed to three different degrees of compactness and the sand was later examined for pupae. In the most compacted sand, the average and maximum

depths of pupation were 1·07 and 4 cm. for *Phormia* and 2·36 and 6 cm. for *Calliphora*. In sand of medium compactness, the average depths were 5 and 7 cm. for *Phormia* and *Calliphora*, respectively; some pupae of *Phormia* and more of *Calliphora* were found at the bottom of the sand, which was 19 cm. deep. In the least compact sand, the number of pupae increased with the depth, the maximum occurring close to the bottom (14 cm. deep).

In order to verify the effect of compactness of the substratum in preventing the larvae from penetrating far, larvae of *P. terraenovae* were placed in containers 20 cm. deep with two layers of sand, of which the upper one was loose. The larvae easily penetrated the loose sand and some pupated in it, but they did not penetrate far into the compact layer and pupated at depths of not more than 2 cm. below the loose sand. Other tests confirmed field observations that in the presence of scraps of dry meat, bones, paper, etc., some of the larvae of *Phormia* do not enter the soil, but attach themselves to these substances and pupate there.

To ascertain the behaviour of larvae under natural conditions, samples of refuse from a box were placed on sand but some were left loose and others pressed to a compact mass. The chief species that developed were *P. terraenovae* and *Musca domestica*, L., and in the case of both the loose and pressed refuse the great majority of the larvae of *Phormia* pupated in it, whereas over 30 per cent. of the larvae of *M. domestica* abandoned even the pressed refuse and entered the sand.

[Vladimirova (M. S.).] Владимирова (М. С.). **The seasonal Distribution and the Number of Generations of Blow-flies.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 548–560, 11 figs., 11 refs. Moscow, 1942.

This is a detailed account of investigations in Moscow in the summer and autumn of 1937 and 1938. The flies were caught in traps baited with ox-liver, and the species taken, in order of decreasing abundance, were *Phormia terraenovae*, R.-D. (*groenlandica*, Zett.), *Calliphora uralensis*, Villen., *Lucilia illustris*, Mg., *L. caesar*, L., *C. erythrocephala*, Mg., *L. sericata*, Mg., and *C. vomitoria*, L. The numbers taken are shown in graphs, and it is concluded that *Phormia* has two generations a year and *C. uralensis*, *L. illustris* and *L. caesar* three. *Phormia* was most numerous in July, *L. illustris* and *L. caesar* in August, *C. uralensis* in September and *C. erythrocephala* in October, but these periods of maximum abundance vary somewhat with the weather. *C. erythrocephala* was most active at a maximum day temperature of 14°C. [57·2°F.] and *Phormia* at one of 31°C. [87·8°F.]. The observations confirmed that *L. sericata* is a thermophilous species [*cf. R.A.E.*, B **25** 210].

[Trofimov (G. K.).] Трофимов (Г. К.). **On the Fauna of the synanthropic Flies of Azerbaijan.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 561–562, 2 refs. Moscow, 1942.

A survey of flies associated with man in Azerbaijan revealed the presence of three species of *Lucilia*, of which *L. sericata*, Mg., was the commonest, *L. caesar*, L., occurred only in humid areas, and *L. ampullacea*, Villen., was rare, only two examples being taken. Notes on the local distribution of these flies are given. *L. sericata* was particularly numerous in Baku and its environs, and the adults were usually taken on human faeces or carcasses of animals. They were present from early spring till late autumn.

The species of *Musca* observed included one identified as *M. sorbens*, Wied., the adults of which are briefly described. They were taken on human faeces and cow-dung in six different localities, chiefly in southern Azerbaijan.

[Vanskaya (R. A.).] Ванская (Р. А.). **The Use of Ammonium Carbonate for the Control of** ***Musca domestica*** **L.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 562–567. Moscow, 1942.

Since ammonia at certain concentrations has been shown to attract females of *Musca domestica*, L. [*R.A.E.*, B **27** 166], experiments were carried out in Moscow in 1938–40 to ascertain whether ammonium carbonate could be used to induce them to oviposit on artificial media, which might then be destroyed. Preliminary tests in which baits of dung, wheat bran and sawdust moistened with an aqueous solution of ammonium carbonate were used showed that more eggs were laid on dung than on bran, and that sawdust was unsuitable as a base, since very few eggs were laid on it, and none when it was not treated with the solution. The numbers of eggs were much greater on treated than on untreated dung and bran. It is concluded therefore that the medium used must afford nourishment for the flies. The optimum concentration of the solution was found to depend on temperature, which affected the rate of evaporation; 20 per cent. was better than 15 or 10 per cent., and 10 per cent. better than 5 in summer at 25°C. [77°F.]. In autumn, at an air temperature of about 13°C. [55·4°F.], 10 per cent. was better than 15 or 20, but in heated quarters (20°C. [68°F.]) 15 per cent was more effective than 20 or 25, and 10 per cent. was not effective at all. Eggs were not laid on bran moistened with water and exposed in premises such as a kitchen and food shops, in which *M. domestica* does not usually oviposit, but when the bran was moistened with ammonium carbonate it was attractive and eggs were laid on it, in decreasing numbers, in a meat and fish shop, a kitchen, a vegetable store room and a grocery shop. The addition of a small quantity of the solution to baits of dung exposed in such breeding places of *M. domestica* as heaps of manure and refuse boxes, induced the flies to oviposit on them in spite of deviating odours, 5 and 10 times as many eggs being laid on such baits, respectively, as on untreated ones.

Baits treated with ammonium carbonate were attractive throughout the year, but more eggs were laid on them in summer than in spring or autumn. The increase was not proportional to the fly population, however, since the majority were attracted to natural breeding places in summer, so that the baits were relatively more effective in spring and autumn, when other breeding places were restricted. Ammonium carbonate also stimulated oviposition, for in heated quarters in autumn, flies about to enter hibernation paired and readily laid eggs on the baits, and in spring many overwintered flies oviposited on them before leaving the buildings. Few did so in winter, however.

Other flies that were attracted to baits moistened with ammonium carbonate and oviposited on them were *Sarcophaga* (*Coprosarcophaga*) *haemorrhoidalis*, Fall., *Hylemyia* (*Paregle*) *cinerella*, Fall., and *Fannia canicularis*, L., in the open, and *F. canicularis* and *Muscina stabulans*, Fall., in restaurants, food shops and bread stalls.

[Zhukova (N. N.).] Жукова (Н. Н.). **Impregnation of Gauze with Insecticides for the Repelling of Flies.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 567–569. Moscow, 1942.

With a view to finding a substance that would prevent blowflies from ovipositing on gauze bandages impregnated with pus from wounds, laboratory experiments were carried out in Moscow in which glass tumblers three-quarters filled with dry or damp sand on which was placed a small piece of meat were covered with gauze that had been impregnated with the test material, dried and folded in three, one edge being turned upwards to allow the flies access to the meat. The flies were released in glass boxes containing the tumblers, and the numbers of eggs laid were estimated 24 hours later. In the case of air-dried sand, the only substances that prevented oviposition were 3 per cent. N-methyldiphenylamine and 3 per cent. chlorpropyldiphenylamine. In the case of sand

containing 5 per cent. by weight of water, 1 per cent. of either of the above or 5 per cent. ethylbenzyldiphenylamine prevented oviposition. Benzyldiphenylamine, xylylphenylamine, diphenylamine, chlorinated turpentine and dixanthogen (ethyldioxythiocarbonate) were ineffective, and no substance prevented oviposition on meat placed on wet sand (8 per cent. moisture content).

When ointments consisting of vaseline and 5 per cent. chlorinated turpentine, N-methyldiphenylamine or dixanthogen were applied to gauze placed over meat in small containers, only the last prevented oviposition, though the others reduced it somewhat, as compared with the control.

[KALANDADZE (L. P.) & CHILINGAROVA (S. V.).] **Каландадзе (Л. П.) и Чилингарова (С. В.). On the Use of sticky Paper against Flies.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 569–572. Moscow, 1942.

An account is given of experiments in Georgia in 1937 and 1938 on adhesives and types of paper for use in the preparation of fly-papers. The best adhesive was a mixture of 5 oz. colophony and 3 oz. castor oil, and it was not rendered more effective by the addition of honey. When machine oil was substituted for castor oil, the mixture was much less effective and dried more quickly. The time for which the fly-papers prepared with the castor-oil mixture could be stored without loss of efficiency depended on the kind of paper used for them. Parchment paper proved the best, but paper of inferior grade was rendered suitable by thinly coating it with carpenter's glue. The fly-papers remained sticky for about 50 days when stored in cardboard boxes in a cellar at a temperature of 18–21°C. [64·4–69·8°F.] but caught hardly any flies after four days' exposure in warm air. They had lost much of their effectiveness in two days, and so should be renewed frequently in practice.

[IVANOVA (Sh. Z.).] **Иванова (Ш. З.). The "SK" Preparation and its Use for Louse Control.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 572–576. Moscow, 1942.

An account is given of experiments in Moscow on the use against lice [*Pediculus humanus*, L.] of a preparation termed SK, the composition of which is not given. It is described as a very thick, viscous, clear fluid that is soluble in alcohol or other organic solvents, but not in water, and has a faint characteristic smell. When small strips of a cotton material were soaked in solutions of SK in alcohol, allowed to dry and then enclosed with lice for 24 hours at 28–30°C. [82·4–86°F.] and 70 per cent. relative humidity, 0·03 and 1 per cent. solutions gave 76·1 and 98·3 per cent. mortality, and in a further test in which females only were used, a 0·07 per cent. solution prevented oviposition. When SK was emulsified in soap and water and tested in the same way, it gave 97·5 and 100 per cent. mortality at 1 and 2 per cent., respectively, and prevented oviposition at 0·25 per cent. Strips of cloth treated with alcohol solutions lost little of their toxicity when kept for 3 weeks at room temperature, though there was a progressive loss after longer periods, but there was considerable reduction in toxicity of both solutions and emulsions after laundering.

When underclothes were soaked in the solutions, dried and then worn beneath infested upper clothing, treatment that left 7 gm. SK per set of underclothes gave almost complete mortality of lice in 10 days, but 3 gm. was ineffective. In further tests, good results were also given by a preparation termed Antipediculin SK, a black liquid mixture that forms stable white emulsions. Underclothes treated with it did not become discoloured and acquired a faint odour of SK. Treatment of underclothing with a 2 per cent. emulsion of this mixture gave almost complete control in 5 days, and when 762 heavily infested persons were dressed in underclothing that had been treated with 5, 8 or 10 per cent. emulsions and not allowed to bath themselves, though

given clean treated underwear at intervals of 10 days, no infestation was found on those examined after 12 or 28 days. Infestations were also eliminated in a few hours and reinfestation prevented by applying ointments consisting of vaseline and 10 or 20 per cent. SK to the seams of underwear, and dusting infested underclothes and beds with a mixture of talc and SK (9 : 1) was also effective in over 350 cases.

Treatment with a hair-oil containing 10 per cent. SK at the rate of 14–17 gm. per head controlled head lice [*P. h. capitis*, Deg.] on 41 women in the course of 24 hours, during which the head was kept bound. Treated heads were observed for a fortnight, but no reinfestation took place. The hair-oil without SK was ineffective.

[Soboleva (N. I.).] **Соболева (Н. И.). The Use of "K" Preparation against Pediculosis.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 576–580. Moscow, 1942.

An account is given of experiments carried out in Moscow on the use against lice [*Pediculus humanus*, L.] of dixanthogen ($C_6H_{10}O_2S_4$), here termed preparation K, which is a light yellow crystalline substance that melts at 28°C. [82·4°F.], has a faint characteristic smell, and is soluble in alcohol and other organic solvents, but is almost insoluble in water. In preliminary tests, the percentage mortality of lice exposed to the vapour given off by cloth treated with 1–10 per cent. solutions of dixanthogen and prevented from coming into contact with the cloth itself was 60·3–74·5, irrespective of the concentration, as compared with 16·7–33·4 in controls, and complete or almost complete mortality was given in 24 hours by placing small amounts of the melted substance on various parts of the bodies of lice. When lice of both sexes were enclosed for 24 hours at 28°C. and 70 per cent. relative humidity with strips of fabric that had been impregnated with 2–10 per cent. alcohol solutions of dixanthogen and dried at room temperature, complete mortality was given and oviposition prevented by concentrations of 2 per cent. and above, and when the lice were kept for 10–300 minutes on fabric treated with a 3 per cent. solution and then transferred to untreated material for 24 hours, the percentage mortality increased from 24·6 for the 10-minute exposure to 96·5 for 300. Exposure for 100 minutes prevented oviposition, but some eggs remained viable after being placed on treated cloth for 96 hours.

In further tests, complete mortality was given in 24 hours by placing the lice on pieces of fabric that had been impregnated with a 2 per cent. emulsion of a mixture of 10 parts dixanthogen, 7 parts soap and 3 parts Petrov's Contact [*cf. R.A.E.*, A **20** 200].

Washing treated fabric considerably reduced the amount of dixanthogen in it and its toxic effect, and the latter was also slightly reduced by keeping the impregnated fabric in a drying cupboard for 30 minutes at 100°C. [212°F.]. When lice were confined in test tubes with two strips of material one of which had been impregnated, they usually congregated on the untreated strip.

Underclothing treated with a 3 per cent. alcohol solution of dixanthogen gave complete control of lice when worn by infested persons for 10 days, and no lice or eggs were found on those that wore them for a month. A special soap, termed K soap and containing 50 per cent. dixanthogen, was also effective when a 3 per cent. solution of it was applied so that 7–10 gm. dixanthogen remained on each set of underclothing, and very few among about 5,000 persons that were given such clothing complained of skin irritation. This treatment is now widely used in Russia. It was later found possible to impregnate clothing by means of an apparatus consisting of two rollers bearing fine needles to which melted dixanthogen was applied ; the clothes were passed between the rollers, so that small amounts of dixanthogen were deposited on them by the needles.

[Gorkina (A. N.).] Горкина (А. Н.). **Insecticidal Effect of Materials impregnated with "SK" and "K" Preparations and worn on the Body.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 581–582. Moscow, 1942.

Complete mortality of lice [*Pediculus humanus*, L.] has been given in 24 hours in the laboratory by an 0·01 per cent. alcohol solution of SK [*cf. R.A.E.*, B **31** 226], but this substance has proved less effective when underclothing impregnated with it is worn by infested persons. Experiments were therefore carried out in which pieces of cotton fabric were soaked in a 1 per cent. solution of SK-30 or SK-43, which contain 46 and 59 per cent. chlorine, respectively, dried and either hung up in a room or tacked on underclothing, so as to come into contact with the body. After 1, 2 and 3 days, strips were cut from the treated fabric and confined with lice in test tubes at 30°C. [86°F.] and 70 per cent. relative humidity. Complete mortality resulted on the material that had not been worn; on the other material the percentage mortality was 86, 54 and 50 for SK-30 and 100, 100 and 90 for SK-43 after 1, 2 and 3 days' wear, respectively. Fabric impregnated with dixanthogen [*cf.* preceding abstract] was then tested in the same way, and it was found that whereas complete mortality resulted after 3 days for all methods of impregnation tested when the fabric was hung up, the percentage mortalities after 1, 2 and 3 days' wear were 60, 35 and 34 for a 1 per cent. alcohol solution, 100, 94 and 100 for a 1 per cent. emulsion prepared from K soap [*cf.* preceding abstract] and 89, 88 and 87 for 1 per cent. dixanthogen emulsified with 1 per cent. Petrov's Contact. It fell to 85 when fabric treated with K soap was worn for 4 days.

[Pivovarov (V. M.).] Пивоваров (В. М.). **Pyrethrum Control of Typhus and Relapsing Fever.** [*In Russian.*]—*Med. Parasitol.* **10** no. 5–6 pp. 582–583. Moscow, 1942.

The usual methods of controlling lice [*Pediculus humanus*, L.] on clothing and other articles are cumbrous and wasteful of labour, and there is a risk of damage to silk, etc. Experiments were therefore carried out in Voronezh in 1939–40 on the use of pyrethrum powder. They showed that lice were paralysed 15 minutes after dusting, and that paralysed individuals died within 24 hours. Contact with the powder for 4 hours usually resulted in complete mortality, but in practice, a shorter exposure is sufficient, as some of the powder clings to the garments and the lice and continues to act on them while the clothes are being worn. Dusting with pyrethrum was of great value in treating the bedding and clothes of families and communities, about 1 lb. of dust being sufficient to treat a family of 4–6 and their property. The dust had no deleterious effect on fabrics, and infestations were practically eliminated in 5 days or less. In most cases, one treatment was sufficient for complete disinfestation, provided that the dusted articles were not shaken out for several days. Though the eggs were not affected, the lice were killed at the moment of hatching. Heads infested with lice [*P. h. capitis*, Deg.] had to be treated twice, at an interval of 5–6 days.

Though pyrethrum powder is harmless to man, it may cause irritation of the skin and should, therefore, be applied to underclothing or hair only when it is not possible to use any other methods.

Monro (H. A. U.). **Tests with a Pyrethrum Aerosol against Cockroaches and Stored Product Pests.**—*73rd Rep. ent. Soc. Ont.* *1942* pp. 61–63, 4 refs. Toronto, 1943.

The author gives the results of tests in Canada with a proprietary aerosol mixture stated to consist of pyrethrins, sesame oil and dichlorodifluoromethane

(1 : 2 : 97) contained in a steel cylinder holding 5 lb. of the mixture and discharging 2 oz. per minute [*cf. R.A.E.*, B **31** 167] against *Blattella germanica*, L., and a number of insects attacking stored products [*cf.* A **31** 460]. A room of 4,000 cu. ft. capacity that was heavily infested with cockroaches concealed in the wooden walls (which had been pierced at intervals with one-inch holes to allow diffusion of sprays of the type usually employed) was treated with 1 lb. of the aerosol. The cockroaches immediately ran out into the open, large numbers were moribund after two hours, and all those in a representative sample died within two days. As the concentration of the aerosol increased in the room, some cockroaches ran outside, and 80 per cent. of these succumbed. The fact that only a few dead cockroaches were found after treatment two days later with 2 quarts of a kerosene spray containing 0·224 per cent. pyrethrins and 2·5 per cent. normal butyl carbitol thiocyanate, discharged with compressed air at a pressure of 90 lb. per sq. in., though many had been found after the same spray had been used in the room previously, demonstrated the effectiveness of the aerosol treatment. The spray produced a heavy deposit of kerosene on the floor, and all the cockroaches inside the room were killed, but those that ran out all survived. The cost of the two treatments is approximately the same, and it is considered that the aerosol may be useful against cockroaches where powders could not be safely or conveniently employed, when control of other insects, such as flies, is desired and, on account of its portability, in isolated situations.

It appeared from the results of the tests on the insects infesting stored products that this aerosol, at a commercial dosage, would not control pests in the holds of ships and other situations where any degree of penetration into cracks and crevices would be required.

ANNAND (P. N.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 19[41–]42.** -60 pp. Washington, D.C., U.S. Dep. Agric., 1942.

Part of this report (pp. 46–49) on entomological work in the United States in 1941–42 deals with Arthropods affecting man and animals. Systematic dipping in derris of all dogs in one area twice each week for four seasons combined with control of meadow mice [*Microtus*] for one season [*cf. R.A.E.*, B **30** 195] was followed by almost complete absence of the American dog tick [*Dermacentor variabilis*, Say], a vector of the eastern type of Rocky mountain spotted fever. A wash of 7 oz. derris (5 per cent. rotenone), $1\frac{1}{2}$ oz. neutral soap and water to make one U.S. gallon was very effective against *D. nigrolineatus*, Pack., killing even the most resistant adults and protecting animals from reinfestation to a considerable degree. In field tests in Texas, all stages of *Haematopinus eurysternus*, Nitzsch, except the eggs [*cf.* **30** 196] were killed by dipping heavily infested cattle in cubé and wettable sulphur that had been used 21 days previously. This discovery that the tank need not be recharged for the second dipping will effect a considerable saving of labour as well as reducing the amount of insecticide formerly used by half. One dipping in cubé and wettable sulphur killed all stages of *Linognathus vituli*, L. P-bromohydrazobenzene and 1-naphthyl methylisothiocyanate were the most toxic of 200 new organic compounds tested against larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, auct.), and both were superior to phenothiazine. The most promising indication from these tests was that certain derivatives of naphthalene are outstandingly toxic to mosquito larvae. It is reported in the section on insecticide investigations (p. 53) that xanthone is more toxic than rotenone to mosquito larvae, being effective at a concentration of 1 part per million parts water.

Mohler (J. R.). **Report of the Chief of the Bureau of Animal Industry, 19[41–]42.**—46 pp. Washington, D.C., U.S. Dep. Agric., 1942.

A report is given of work carried out in the year ended 30th June 1942 on the eradication of *Boophilus annulatus*, Say, on cattle and other animals in the United States. No change was made in the quarantined area [*cf.* *R.A.E.*, B **30** 131]. Experiments on the transmission of equine infectious anaemia [swamp fever] by insects [**31** 102] included some in which inapparent cases were produced by bites of females of *Psorophora confinnis*, Lynch (*columbiae*, D. & K.) that had first fed on an infected horse. The results of four attempts to transmit anaplasmosis of cattle from carriers to susceptible animals by the bite of *Tabanus sulcifrons*, Macq. [*cf.* **30** 100] were consistently negative for six months. Three susceptible bovines exposed to lice (*Linognathus vituli*, L.) that had fed on an animal with clinical symptoms of anaplasmosis had failed to develop the disease four months later, and injecting a suspension of 150 lice from a clinical case into a susceptible bovine also failed to produce it. In experiments in Colorado, New Mexico and Texas, in which a commercial hymolosalt was substituted for soap in derris or cubé washes for the control of ox warbles [*Hypoderma lineatum*, Vill.] [*cf.* **30** 131], about 91–97, 75–80 and 37–52 per cent. control was effected, respectively. The reason for the variability of the results was not determined, but they did not appear to be influenced to any extent by the hydrogen-ion concentration of the wash. The substitution of hymolosalt for soap seemed to improve effectiveness slightly. Dips made of 1 oz. derris or cubé powder, 0·25 oz. hymolosalt and 1 U.S. gal. water or 1·6 oz. derris or cubé powder and 1 U.S. gal. water without hymolosalt were about as effective as standard washes, the second giving about 98 per cent. kill of larvae in tests in Colorado. The cattle should be kept in the dip for about two minutes. Effectiveness was only slightly increased by scrubbing the backs of the animals while they were in the bath. About 700 sheep in Colorado infested with *Melophagus ovinus*, L., were dipped once in a suspension of 4 oz. derris powder (5 per cent. rotenone) per 100 U.S. gals. water. None was observed to have become reinfested during frequent inspections in the course of the following 92 days, during which time they mingled with infested sheep.

Eddy (G. W.). **Some Fleas collected from the Oklahoma Cottontail Rabbit,** *Sylvilagus floridanus alacer* **(Bangs).**—*J. Kans. ent. Soc.* **16** no. 1 pp. 1–3, 3 refs. Manhattan, Kans., 1943.

Data are given on the fleas collected on 176 cottontail rabbits (*Sylvilagus floridanus alacer*) taken in Oklahoma in the course of study on the seasonal history of *Haemaphysalis leporis-palustris*, Pack. [*R.A.E.*, B **31** 130]. They comprised 3,080 examples of *Hoplopsyllus affinis*, Baker, 194 of *Cediopsylla simplex*, Baker, 47 of *Echidnophaga gallinacea*, Westw., six of *Pulex irritans*, L., two of *Ctenocephalides felis*, Bch., one of *Ceratophyllus* (*Orchopeas*) sp., probably *sexdentatus*, Baker, and one of *C.* (*O.*) *leucopus*, Baker. The average number of individuals of each sex of the first two species taken per rabbit in each month of 1939 is shown in a table. *H. affinis* was collected in every month, but *Cediopsylla simplex* was not found in September, October or November.

Heffelfinger (J.). **An observed Infestation and Treatment of** *Psoroptes cuniculi* **in the Ears of Laboratory Rabbits.**—*Ohio J. Sci.* **43** no. 4 p. 181, 1 ref. Columbus, Ohio, 1943.

A case is recorded from Ohio of heavy infestation of the ear of a laboratory rabbit by *Psoroptes cuniculi*, Delafond [*cf.* *R.A.E.*, B **17** 102]. The mites were abundant in heavily scabbed material in the outer ear and also occurred in the inner ear and semicircular canals, and the rabbit exhibited convulsions and loss of equilibrium. Treatment before the inner ear is attacked consists

in swabbing the area affected with a mixture of equal parts of glycerine (to soften the scabs for removal) and 5 per cent. phenol (to kill any mites left on the skin). In most cases, two or three daily applications give effective control.

Gillain (J.). *Otodectes cynotis* **var.** *africana.* **Un nouvel acarien du chat.**—*Bull. agric. Congo Belge* **33** no. 1–2 pp. 110–111. Léopoldville, 1942.

The measurements are given of *Otodectes cynotis* var. *africana*, n., a small mite found in the north-eastern Belgian Congo in the external auditory meatus of a domestic cat that had spent several weeks in the bush. The infestation was accompanied by violent pruritus, and abundant dark brown cerumen enclosing mites in all stages of development was found in the ear.

Gillain (J.). **Gale du porc à** *Sarcoptes scabiei* **var.** *parvula* **Canestrini.**—*Bull. agric. Congo Belge* **33** no. 1–2 pp. 112–113. Léopoldville, 1942.

This paper deals with the mange caused in pigs by *Sarcoptes parvulus*, Can., which is recorded in the Belgian Congo for the first time. The measurements of the adult male and female mites are given. Infestation starts in the external auditory meatus, where it often escapes detection but occasionally causes fits resembling epilepsy, and spreads to the neck and shoulder region and eventually the whole body. Dry, silvery scabs are formed, and finally the skin becomes dry and wrinkled, and the bristles fall. The animals are restless, with more or less marked pruritus. Infestation inhibits fattening and is often fatal in very young pigs. The usual measures taken for the control of sarcoptic mange are considered applicable. Dips are strongly recommended, particularly if the animals are first kept for a considerable time in the sun or in a warm place to bring the mites to the surface, as the burrows of the females are very deep. Living quarters should be carefully disinfected and all objects serving as rubbing posts disinfected, removed or burnt. Man may be experimentally infested, but spontaneous cure takes place after 8–10 days.

Carter (H. B.). **A Note on the Occurrence of the Follicle Mite (***Demodex* **sp.) in Australian Sheep.**—*Aust. vet. J.* **18** pp. 120–124, 4 figs., 5 refs. Sydney, 1942.

The occurrence of *Demodex* sp. in three ewes in New South Wales and two in South Australia was discovered during routine examination of serial sections of skin samples taken from living sheep. There were no clinical signs of infestation and no macroscopic lesions, with the exception of one very small pustule. There were very few signs of inflammation when mites were present, but folliculitis or peri-folliculitis was often marked in the absence of mites, and there were many cases of it in other sheep of the flock in which the New South Wales infestations were found, though none of these sheep appeared to carry mites. It is possible that *Demodex* favours bacterial infections which, once established, make the follicles unsuitable for it. The mites showed marked affinity for the primary follicles in all cases, most of them being in the lobes of the primary sebaceous glands, but many in the hair funnel near the openings of the lobes. Four of the five infested ewes were of types (Border Leicester and fine-wool merino crosses and strong-wool merinos) in which only the primary follicles are likely to be large enough to accommodate the mites. If follicle size is important in this simple way, fine-wool merinos are unlikely to become infested, as none of the follicles would be large enough.

Notes are given on the distribution of *Demodex* mites in sheep, from which they have not previously been recorded in Australia, and references are made to highly divergent views on their pathological importance [*cf. R.A.E.*, B **3** 119; **13** 134; **23** 158].

Aziz (M.). **A simple Device for destroying Adult Mosquitoes, House-flies and other Household Pests by the use of a Flame Thrower.** —*Trans. R. Soc. trop. Med. Hyg.* **36** no. 6 pp. 364–365. London, 1943.

A "flit-gun" fitted with a small burner to ignite the spray has been successfully used by the author for several years to destroy mosquitos and other insects in outbuildings, etc., where there is no risk of damage or fire. It throws out a tongue of flame $1\frac{1}{2}$–2 ft. long and 6–8 inches wide at each stroke. The burner is a tube of about $\frac{1}{4}$-inch bore, $1\frac{1}{4}$ inches high, soldered on the container 2–$2\frac{1}{2}$ inches in front of the nozzle and holding a wick that draws its fuel from the container. The usual petroleum insecticides and also light fuel oil were satisfactory. The burner gives enough light for work in dark places, and the smoke dislodges the insects and exposes them to the action of the spray or flame.

Papers noticed by Title only.

Smit (B.). **The Control of Household Insects in South Africa.**—*Bull. Dep. Agric. For. S. Afr.* no. 192 (2nd edn.) 42 pp., 1 col. pl., 18 figs., 14 refs. Pretoria, 1943. Price 6*d*. [*Cf. R.A.E.*, B **28** 21.]

Cuthbertson (A.). **The Skin Maggot Fly** [*Cordylobia anthropophaga*, Grünb., in S. Rhodesia]. **Life History and Preventive Measures.** —*Bull. Dep. Agric. S. Rhod.* no. 1201, 4 pp., 2 pls., 2 refs. Salisbury, S. Rhod., 1942. [See *R.A.E.*, B **31** 32.]

Jack (R. W.). **Ticks infesting Domestic Animals in Southern Rhodesia.**—*Bull. Dep. Agric. S. Rhod.* no. 1205, 31 pp., 1 diagr., 28 figs., 17 refs. Salisbury, S. Rhod., 1942. [See *R.A.E.*, B **31** 40.]

Chorley (J. K.). **Tsetse Fly Operations. Short Survey of the Operations** [against *Glossina* spp. in S. Rhodesia in 1940] **by Districts.** —*Bull. Dep. Agric. S. Rhod.* no. 1177, 9 pp. Salisbury, S. Rhod., 1941. [See *R.A.E.*, B **30** 54.] **Tsetse Fly Operations, 1941. Short Survey of the Operations by Districts for the Year ending December, 1941.**—*Op. cit.* no. 1208, 6 pp. 1942. [See **31** 40, 80.]

Malbrant (R.). **Gibier, tsé-tsés et trypanosomiases.** [A discussion of the effect of game destruction on *Glossina*, sleeping sickness and trypanosomiasis of domestic animals.]—*Rev. Sci. méd. Afr. franç. libre* **1** no. 2 pp. 73–87, 2 refs. Brazzaville, 1942. [See *R.A.E.*, B **29** 161.]

Bequaert (J.). **A Monograph of the Melophaginae, or Ked-flies, of Sheep, Goats, Deer and Antelopes (Diptera, Hippoboscidae).**—*Ent. amer.* **22** nos. 1–4 pp. 1–210, 19 figs., many refs. Lancaster, Pa., 1942.

King (W. V.), Bradley (G. H.) & McNeel (T. E.). **The Mosquitoes of the southeastern States.**—*Misc. Publ. U.S. Dep. Agric.* no. 336 (revd.), 96 pp., 6 pls., 26 figs., 151 refs. Washington, D.C., 1942. [*Cf. R.A.E.*, B **28** 31.]

Senevet (G.) & Abonnenc (E.). **Les moustiques de la Guyane française. Le genre *Culex*. –2. Nouvelle espèce du sous-genre *Melanoconion*.**—*Arch. Inst. Pasteur Algérie* **19** no. 1 pp. 41–44, 1 fig., 1 ref. Algiers, 1941. [Recd. 1943.] [*Cf. R.A.E.*, B **27** 248.]

Parrot (L.). **Note sur les phlébotomes. XXXIV bis.—Sur les "épines géniculées" des phlébotomes (Erratum).** —*Arch. Inst. Pasteur Algérie* **19** no. 1 pp. 45–46, 3 figs. Algiers, 1941. [Recd. 1943.] [*Cf. R.A.E.*, B **30** 149–150.]

ROZEBOOM (L. E.). **The Mosquitoes of Oklahoma.**—*Tech. Bull. Okla. agric. Exp. Sta.* no. T-16, 56 pp, 78 figs., 3 maps, 34 refs. Stillwater, Okla., 1942.

The results are given of a mosquito survey of Oklahoma made in 1938–40. The physiography and climate of the State and the procedure used are described. Notes on each type of situation in which immature stages were found are followed by a table showing the number of larvae of each species taken in each type of breeding place. An attempt is made to estimate the relative abundance of the 40 species known to occur in the State, but the results are not strictly accurate as it was impossible to devote equal attention to all methods of collection or all parts of the State. However, the most abundant species was certainly *Anopheles punctipennis*, Say, which constituted 5·8 per cent. of the adults, 14·4 per cent. of the larvae and 12·9 per cent. of the total. *A. quadrimaculatus*, Say, comprised 15·5 per cent. of the adults, only 5·0 per cent. of the larvae and 6·9 per cent. of the total. Larval associations and seasonal distribution of adults and larvae are discussed, and the numbers of times that larvae and pupae of the various species were collected with each of the other species and the number of larvae and adults of each species taken in each month are shown. Keys are given to the females, larvae and male terminalia of the 40 species and are followed by notes on the morphology, distribution in the State and habits of each. There is a very brief and general section on control.

EYLES (D. E.) & BISHOP (L. K.). **The Microclimate of Diurnal Resting Places of *Anopheles quadrimaculatus* Say in the Vicinity of Reelfoot Lake.**—*Publ. Hlth Rep.* **58** no. 6 pp. 217–230, 4 graphs, 3 refs. Washington, D.C., 1943.

An account is given of observations made during August and September 1941 on the microclimate of daytime resting places of females of *Anopheles quadrimaculatus*, Say, near Reelfoot Lake, Tennessee. They included seven barns and the underparts of a frame building and a small bridge, and movements at dusk and dawn were observed in two of the barns. The methods are described.

The following is based on the authors' summary and conclusions. Most of the females left the resting places in the 20 minutes following sunset. The only microclimatic condition that could be consistently correlated with this movement was the decrease in light intensity. In the open, this fell from a mean of about 48 foot candles at sunset to 2 foot candles 20 minutes later. If the shelter was artificially lighted, a large proportion of the mosquitos remained until the light was extinguished about two hours after sunset. The females tended to enter the resting places during the hours following sunrise, but the movement was gradual and seemed to depend upon when direct sunlight struck them in the open. Temperatures within the shelters were lower during daylight hours and humidities were higher than those outside. These differences averaged 7°F. and 8 per cent., respectively, during the hottest part of the day. The rate of evaporation within the resting places was only about two-thirds of that outside, and would be only a small percentage of the rate to which a mosquito would be subjected if exposed to the direct light of the sun and action of the wind.

PARKER (R. R.) & STEINHAUS (E. A.). **Rocky Mountain Spotted Fever: Duration of Potency of Tick-tissue Vaccine.**—*Publ. Hlth Rep.* **58** no. 6 pp. 230–232, 1 ref. Washington, D.C., 1943.

One lot of Rocky Mountain spotted fever vaccine prepared from infected tissues of *Dermacentor andersoni*, Stiles [*cf.* *R.A.E.*, B **15** 217, etc.] in 1928 and two lots prepared in 1929 were retested for potency in March 1942. They

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had been stored in the interim at 34–40°F. Their protective values appeared to be undiminished. The method of testing is described, and the results are given.

Davis (D. J.), McGregor (T.) & DeShazo (T.). *Triatoma sanguisuga* **(Le Conte) and** *Triatoma ambigua* **Neiva as natural Carriers of** *Trypanosoma cruzi* **in Texas.**—*Publ. Hlth Rep.* **58** no. 9 pp. 353–354, 8 refs. Washington, D.C., 1943.

Many crithidia and metacyclic trypanosome forms were found in faecal matter from 4 out of 9 living individuals of *Triatoma sanguisuga*, Lec., and 2 out of 6 of *T. ambigua*, Neiva, taken in Texas in 1942. The bugs were identified by H. G. Barber; *T. ambigua* has previously been considered a subspecies of *T. sanguisuga* [*cf. R.A.E.*, B **29** 17]. A saline suspension of the dejecta from each positive insect was inoculated intraperitoneally into one or more young desert mice (*Peromyscus eremicus*), and all the latter became infected with *Trypanosoma cruzi*, which was found in their blood 8–16 days later. These records bring the total number of Triatomids that have been found naturally infected with *Trypanosoma cruzi* in the United States to eight [*cf.* **24** 206; **28** 246; **29** 192].

Blanc (G.) & Baltazard (M.). **Recherches expérimentales sur la peste. L'infection de la puce de l'homme,** *Pulex irritans* **L.**—*C. R. Acad. Sci.* **213** no. 22 pp. 813–816. Paris, 1941. [Recd. 1943.]

The usual methods of flea collection adopted in studies of the epidemiology of plague are such that rat fleas are collected and *Pulex irritans*, L., is not, as it is generally assumed that the disease is transmitted from rats to man and not from one man to another. In view, however, of the frequent occurrence of successive cases in individual families during an outbreak of plague in Morocco, investigations were made on the possible importance of *P. irritans* as a vector. The fleas were collected in the following manner. As soon as possible after a death from plague, the corpse was stripped and removed. All the clothes and coverings used by the deceased were left in the room, and the door and all openings by which light could enter were sealed up. After 4–5 days, the door was opened and a large shallow white dish, half filled with water, was quickly placed in the shaft of light from it. The hungry fleas were at once attracted to the white surface and fell into the water, whence they were collected in glass tubes. Batches ranging from 1 to 200 fleas were obtained, and 29 strains of plague were isolated by injecting suspensions of them into guineapigs or rats. In all the cases that gave positive results the animals died of plague 3–7 days later. Infection was similarly demonstrated in a batch of about 200 fresh fleas that had been allowed to feed on a patient dying of plague. It was shown to persist for 21 days in living fleas from houses of persons who had died of plague and for five days in dead fleas or in the excreta of fleas under natural conditions. A mouse was successfully infected by placing a few drops of diluted excreta on the mucous membrane in the mouth. Finally, three guineapigs in succession were successfully infected by the feeding of a mixed batch of several hundred fleas from the houses of dead persons.

Sparrow (H.) & Mareschal (P.). **Innocuité pour l'homme de la piqûre du pou typhique et données expérimentales sur les conditions de l'infection typhique.**—*C. R. Acad. Sci.* **215** no. 17 pp. 389–391. Paris, 1942.

These experiments were carried out in view of doubts as to the ability of *Pediculus humanus*, L., to transmit typhus by its bite. In the first series, batches of 60–100 lice that had been infected 6–8 days previously by anal

injection with murine or epidemic (louse-borne) typhus were fed on 11 mental patients. In some cases the lice, the feeding cages and the skin where the cages had been placed were disinfected with alcohol, but in others this was omitted and the patients were encouraged to scratch the skin soiled with excreta after the cage was removed. No infection resulted, though the excreta were shown to be rich in virulent ricksettsiae. Most of the patients were subsequently shown to be susceptible to the strains to which they had been exposed, as infection was obtained by placing on the forearm a drop of normal saline containing excreta or intestine from infected lice and scarifying the skin or by placing intestine or the dried or powdered excreta of infected lice on the conjunctiva.

HASE (A.). **Ueber Entlausung durch Ameisen sowie über die Wirkung der Ameisensäure auf Kleiderläuse.** [Delousing by Ants and the Action of Formic Acid on Clothes Lice.]—*Z. Parasitenk.* **12** pt. 6 pp. 665–677, 7 figs., 7 refs. Berlin, 1942.

The use of ants to destroy *Pediculus humanus*, L., in clothing is an old practice in Germany [*R.A.E.*, B **4** 35], and in experiments with artificially infested fabrics placed on nests, all lice, eggs and excreta were removed or eaten in 24 hours by *Lasius fuliginosus*, Latr., while *L. flavus*, L., cleared off all the lice and nearly all the eggs. *Formica rufa* var. *rufopratensis*, Forel, destroyed the lice, eggs and excreta, but damaged the fabric. Such treatment is uncertain, however, and is ineffective if the lice are protected by folds in the material. The author also examined the toxic effect on lice of formic acid, in view of a recent recommendation in Germany that clothes should be treated with a preparation containing 25–27 per cent. of the acid and sold as Formazin. The lice were killed by immersion for 10 minutes in a 25 per cent. solution of the acid, but some eggs survived 20 minutes' immersion ; and exposure to a high concentration of the vapour of formic acid killed the lice in 3 hours, but not the eggs. Acetic acid gave similar results. It is concluded therefore that formic acid is not suitable for the treatment of clothing, especially as there is danger of skin irritation from its use.

WILLMANN (C.). **Zwei neue Trombidioseerreger aus der Steiermark.** [Two new Mites causing Trombidiosis in Styria.]—*Z. Parasitenk.* **12** pt. 6 pp. 639–644, 4 figs., 2 refs. Berlin, 1942.

Infestation of man by *Trombicula autumnalis*, Shaw, the common harvest mite in Austria and other parts of central Europe, does not begin before midsummer, but Trombidiid infestation in early spring occurs in a number of mountain localities, including one in South (Italian) Tyrol, where the species concerned is *T. desaleri*, Methlagl [*R.A.E.*, B **18** 126], and one near Graz. Two Trombidiid larvae found in soil samples from the latter locality are described as *T.* (*Eutrombicula*) *vernalis* and *T.* (*Neoschöngastia*) *xerothermobia*, spp. n.

GERMER (W. D.) & BEHRENS (H.). **Ein Beitrag zur Stechmückenfrage von Gran Canaria.** [A Contribution to the Mosquito Question of Grand Canary.]—*Z. Parasitenk.* **12** pt. 6 pp. 645–658, 7 refs. Berlin, 1942.

Except for some cases of malaria in the south of the island (the only district in which Anophelines occur) Grand Canary is free from endemic mosquito-borne disease. There were three epidemics of yellow fever in the 19th century, but it has not been recorded since, in spite of considerable traffic with the endemic regions of West Africa and South America, a favourable climate, and a high index of *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.), which is represented by var. *canariensis*, Pittaluga. The other Culicines comprise five species of *Culex*

[*cf. R.A.E.*, B **18** 77] and *Theobaldia longiareolata*, Macq. *A. aegypti* constituted 20–30 per cent. of the mosquitos found in houses in the urban district of Las Palmas, but it was not taken at altitudes above about 1,150 ft. The peak of mosquito abundance and the highest average temperature (27–28°C. [80·6–82·4°F.]) occur in September, but mosquitos are numerous in other months, and even in winter, with an average temperature of 17°C. [62·6°F.], the percentage of *A. aegypti* is not markedly different. The egg, larval and pupal stages lasted 1–2, 12–15 and 2–4 days at 20°C. [68°F.]; the adults lived for 14–18 days, and eggs were laid two days after a blood meal. When reared in water containing urine, ammonia, sodium chloride, sea-water, grape sugar, hydrochloric acid, sulphuric acid, nitric acid or potassium hydroxide, the larvae were able to develop in much higher concentrations than could those of *C. pipiens*, L., or *T. longiareolata*. Their control is difficult because water is stored in quantity, the rainfall averaging only 4 ins. a year. There are 1,640 large open tanks in the urban district of Las Palmas alone, besides those in houses. Goldfish and guppy fish [*Lebistes reticulatus*] were placed in tanks that were suitable, and the keeping of ducks was advised. A mixture of equal parts of kerosene and Diesel oil proved effective for oiling, at the rate of 0·6 fl. oz. per sq. yd.

Pavlovskiĭ (E. N.). **A most simple Method for destroying Mosquitoes** (*Phlebotomus*) **by catching them with a Racket in Buildings of European Type. (Contribution to the Prophylaxis of Pendinka and Papatassi-fever.)**—*C. R. Acad. Sci. URSS* (N.S.) **37** no. 4 pp. 150–152, 4 figs. Moscow, 1942.

If sandflies (*Phlebotomus*) cannot be controlled by destroying their breeding places, measures should be taken against them in houses. These include dusting such places as cornices and corners near the ceiling, where they rest, with pyrethrum powder or spraying them with a fly spray of pyrethrum extract in kerosene. If these insecticides are not available, the sandflies can be caught by passing a piece of board attached to a handle and covered with some viscous substance along cornices and other places where they congregate. Two pieces of board set at right angles can be used for corners. This method was successfully employed by the author in Persia in 1942.

Lucas (G. C.). **Procedimientos para combatir la garrapata de las gallinas—** *Argas persicus* **(Oken) 1818.** [Processes for combating the Fowl Tick, *A. persicus*.]—*Alm. Minist. Agric. Argent.* **15** pp. 97–102, 16 figs. Buenos Aires, 1940. [Recd. 1943.]

Brief notes are given on the appearance and habits of the fowl tick, *Argas persicus*, Oken, which has spread rapidly in Argentina since its accidental introduction some 30 years ago. To eradicate tick infestation the birds should be held for a minute in a solution of 1 lb. sodium fluoride in 4 gals. tepid water, penetration of the liquid being assisted by the hand, and the head should be immersed very quickly once. The birds should then be kept for ten days in a clean temporary poultry house and dipped a second time before transfer to their permanent quarters. The original fowl house should be burnt or suitably disinfested if the birds are to be returned to it. Various methods of doing this are described, largely from the literature.

Girotto (G.). **Sobre un parásito muy común en la Patagonia, garrapata ovina,** *Melophagus ovinus*. [*M. ovinus*, a very common Parasite in Patagonia.]—*Alm. Minist. Agric. Argent.* **15** pp. 209–212, 2 figs. Buenos Aires, 1940. [Recd. 1943.]

The author has recently found that *Melophagus ovinus*, L., is common on sheep in Tierra del Fuego, and gives notes on its biology and recommendations

for its control by nicotine dips ; two treatments at an interval of 3–4 weeks are required.

Amaral (J.). **Infecção natural de** *Nissorhynchus Kerteszia* **especies** *cruzi* **e** *bellator* **(Diptera, Culicidae). Nota prévia.**—*Folha med.* **23** no. 15 p. 171. Rio de Janeiro, 1942.

Anopheles (*Nyssorhynchus*) *cruzi*, D. & K., and *A.* (*N.*) *bellator*, D. & K., are the predominant Anophelines in various parts of the malarious coastal region of Paraná, Brazil, and attack man avidly both by night and day. Oöcysts were found in 1 of 444 females of the former and in 2 of 307 of the latter taken in houses [*cf. R.A.E.*, B **29** 173 ; **31** 80]. No sporozoites were found, but it is pointed out that the mosquitos were taken in districts where intensive therapy had been practised.

da Fonseca (J. A. B.) & da Fonseca (F.). **Transmissão da malária humana por anofelinos da série** *tarsimaculatus*. [The Transmission of human Malaria by Anophelines of the *tarsimaculatus* Series.]—*Mem. Inst. Butantan* **16** (1942) pp. 93–124, 12 pls., 53 refs. São Paulo, 1943. (With a Summary in English.)

The authors give lists showing the Brazilian Anophelines that have been infected with malaria parasites in the laboratory, with notes on the identity of some of them in the light of subsequent nomenclatorial changes, and an account of experiments in 1940–41 with females of *Anopheles oswaldoi*, Peryassú, vars. *oswaldoi* and *guarujaensis*, Ramos, bred in the laboratory from females taken at a seaside resort near Santos, where malaria occurs. They were starved for 1–3 days, fed on gametocyte carriers and subsequently on guineapigs and dissected after suitable intervals. The results are shown in detail in tables and are discussed. Var. *guarujaensis* fed on man more readily than did var. *oswaldoi*, but though higher total percentages became infected, the percentages were much the same when both varieties were fed on the same patient on the same day. At 16–28°C. [60·8–82·4°F.], in June-October, the extrinsic cycle was completed in minima of 25 and 25 days for *Plasmodium vivax* and 22 and 33 for *P. falciparum* in vars. *guarujaensis* and *oswaldoi*, respectively, at 23–33°C. [73·4–91·4°F.], in December, it lasted 8 days for *P. vivax* and 18 for *P. falciparum* in var. *guarujaensis*, and at 20–33°C. [68–91·4°F.], in November–February, 15 days for *P. vivax* in var. *oswaldoi*. Var. *guarujaensis* is the most numerous Anopheline in houses in the resort, and 3 of 165 females taken in houses there showed oöcysts on the stomach ; it was probably responsible for the local outbreaks of malaria in 1940–41.

Saliternik (Z.) & Theodor (O.). **On a new Variety of** *Anopheles turkhudi* **from Palestine.**—*J. Malar. Inst. India* **4** no. 4 pp. 429–434, 9 figs., 13 refs. Calcutta, 1942.

Descriptions are given of the larva and adults of both sexes of *Anopheles turkhudi* var. *telamali*, n., which was found in Tel Amal, in the eastern plain of Esdraelon, in 1940 and 1941. The larvae were found in seepage water originating from a fish-breeding pond and having a rich surface vegetation and a temperature of 22°C. [71·6°F.]. They remained at the bottom most of the time, coming to the surface for a few moments only, when they adopted a characteristically Culicine attitude, as do those of the typical *A. turkhudi*, List. As only two adults were taken in houses among a large number of *A. sergenti*, Theo., it is assumed that *A. t. telamali* is not a domestic mosquito. The distribution of *A. turkhudi* and its varieties is briefly reviewed from the literature.

IYENGAR (M. O. T.). **Studies on Malaria in the Deltaic Region of Bengal.**—*J. Malar. Inst. India* **4** no. 4 pp. 435–446, 1 map, 1 graph, 15 refs. Calcutta, 1942.

The deltaic region of Bengal is remarkable in that very little malaria occurs in the wet areas where the water table is high and a great deal in the dry ones where it is low [*cf. R.A.E.*, B **18** 31, 132–133]. In the course of a study made in 1929–37 in the 24-Parganas District in eight villages with spleen rates varying from 0 to 43·07 per cent., all situated within four miles of one another and differing noticeably only in the subsoil water level, 13 species of *Anopheles* were found, nine of which were fairly common. Dissections of females caught in the most malarious areas showed infection rates of 15·5 per cent. in *A. philippinensis*, Ludl., and 0·7 per cent. in *A. varuna*, Iyen., the sporozoite rates being 12·7 and 0, respectively [*cf.* **20** 197 ; **29** 7, etc.]. This indicates that *A. philippinensis* is the primary vector. The main breeding places were ponds and ditches, many of which served as sources of domestic water supply. Results of larval collections made twice monthly are shown in a table. There was a strong positive correlation between the number of larvae of *A. philippinensis* taken and the spleen rate at the place of capture. The co-efficient of correlation between the spleen rate and the percentage incidence of *A. philippinensis* among the total number of Anopheline larvae collected was also significant. The incidence of *A. varuna* did not show any constant relation with spleen rates, and it does not appear important in the determination of local endemicity. *A. philippinensis* was most prevalent from July to October [*cf.* **20** 81]. Ponds of similar type occur in similar numbers in all the villages studied, so that there does not appear to be any difference in availability of breeding places, but the population of *A. philippinensis* is closely related to the level of the water table during the breeding season. The reason for this is not known, but it would appear that breeding of this species is associated with the presence of certain types of algal plankton, the development of which is inhibited by the lack of soil aeration resulting from a high subsoil water level. It is concluded that control measures should be directed primarily against *A. philippinensis*, but it is pointed out that species control is difficult because the preferred breeding places of this Anopheline do not differ essentially from those of others. It should, however, be possible to control it by introducing and conserving water to raise the level of the water table during the breeding season.

DE BURCA (B.) & MOHAMMED YUSAF. **A new Variation of *Anopheles gambiae*.**—*J. Malar. Inst. India* **4** no. 4 pp. 447–449, 1 fig., 1 ref. Calcutta, 1942.

Mosquitos bred from larvae collected from rainwater in an air-raid shelter at Massawa, Eritrea, in December 1941 comprised *Anopheles gambiae*, Giles, *A. dthali*, Patt., and a single female somewhat pale in colour that is thought to be a pale form of *A. gambiae*, though it does not correspond to the known albinoid forms of this species. A description of it is given.

WIJESUNDARA (D. P.). **Notes on the Mosquito Fauna of Rot-holes in Trees and Bamboo Stumps in Ceylon.**—*J. Malar. Inst. India* **4** no. 4 pp. 451–456, 1 graph, 5 refs. Calcutta, 1942.

Information on mosquito-breeding in bamboos and rot-holes in trees in Ceylon is reviewed, and data are given on mosquitos reared from water and débris in the fork of a tree in Colombo between 15th October 1940 and 25th November 1941 and from rot-holes in trees and bamboo stumps in hill districts (450–3,300 ft.) between early November 1940 and February 1942. In all, 7,300 adults of 12 species were bred from water from the Colombo tree, including

3,524 of *Culex brevipalpis*, Giles, 1,797 of *Aëdes albopictus*, Skuse, 1,688 of *A. gubernatoris*, Giles, 199 of *C. fatigans*, Wied., and 39 of *A. aegypti*, L. The mosquitos from the hill districts comprised 1,420, representing 19 species, from 29 samples of water from holes in various trees and 1,352, representing 17 species, from 23 samples of water from the stumps of the giant bamboo. The most abundant species were *A. albopictus*, *Armigeres obturbans*, Wlk., and *C. uniformis*, Theo. *Anopheles leucosphyrus*, Dön., which normally occurs in ground water collections, was found on five occasions.

Covell (G.) & Pritam Singh. **Malaria in the Coastal Belt of Orissa.**—*J. Malar. Inst. India* **4** no. 4 pp. 457–593, 2 maps, 1 graph, 18 refs. Calcutta, 1942.

An account, including very detailed tabulated data, is given of observations made between 22nd April 1939 and 25th March 1942 on malaria and Anophelines on the western and southern shores of Chilka Lake and along the coast of Orissa as far south as Gopalpur. The physical features and climate of the region are described, and the history of malaria in it is reviewed [*R.A.E.*, B **4** 118; **25** 254; **28** 163]. The vector is *Anopheles sundaicus*, Rdnw., and the fact that it was not found before 1936 is attributed to failure to carry out investigations at the right season. It was probably present in 1912 when A. B. Fry found malaria to be hyperendemic. Routine spleen and blood examinations showed that the disease is irregularly distributed. Hyperendemic conditions prevail in certain villages, and serious epidemics occur from time to time in spring or autumn.

Collections of adult Anophelines and larval collections from all breeding places within half a mile of the periphery of each village studied yielded 17 species. Brief notes are given on the prevalence and habits of those other than *A. sundaicus*, which is treated in detail. Its incidence and density were extremely variable. Of the adults taken, 8,835 were caught in huts occupied by man, 4,237 in huts occupied by man and cattle and 3,866 in cattle-sheds. Its principal breeding places were Chilka Lake and reservoirs, pools, swamps and rice-fields subject to flooding by saline water, but it was found breeding in water of low salinity never flooded with sea water in some inland villages. The optimum range of salinity was 600–800 parts per 100,000, and a salinity above this range was more inhibitory than one below it, but salinity was probably of importance only in so far as it affected vegetation. Breeding was associated with the presence of putrefying masses of algae or other weeds, but not with growing vegetation. Wave action had the adverse effect of disturbing the water surface and stranding vegetation on the shore. Culicine larvae were always present when breeding of *A. sundaicus* was intensive. Correlation between the prevalence of *A. sundaicus* and of malaria was very marked. In the course of the dissection of 10,714 females of *A. sundaicus*, 20,844 of *A. annularis*, Wulp, 2,305 of *A. culicifacies*, Giles, 674 of *A. aconitus*, Dön., and 450 of *A. varuna*, Iyen., 32 gut and 51 gland infections were found in the first and one gut infection in the second. All the 82 infected females of *A. sundaicus*, with the exception of one with a gut infection, were caught in villages where transmission was occurring, and in huts occupied by man with or without cattle; 48 were caught between September and December, inclusive, and 30 between January and May, the greatest numbers being taken in October and February. The monthly infection rate during epidemics was usually only about 1·5–3·0, except in one village in February 1941 when it was 9·2.

A special survey of the eastern side of the Lake made in June 1940 showed that there also malaria was hyperendemic, spleen rates being extremely high and spleens very large. No infected females of *A. sundaicus* were found, but larvae and adults were present in many villages, and it is concluded that it is the vector there and also in the villages at the northern end of the Lake. In

observations made between November 1941 and March 1942, spleen rates and the number of adults of *A. sundaicus* were found to decrease as the distance inland from Chilka Lake increased.

In experiments carried out in 1941, breeding of *A. sundaicus* was completely stopped in three reservoirs which were kept free from weeds and algae, but it continued, though on a greatly reduced scale, in one in which *Chaetomorpha* remained. It was impossible to keep this reservoir free from the alga by hand, and copper sulphate at 1 : 420,000 had no appreciable effect, but a further application at 1 : 60,000 checked its growth and breeding of the Anopheline stopped. The removal of weeds from reservoirs and borrow pits in other villages was followed by cessation of breeding in all cases. In larger-scale experiments carried out between September 1941 and March 1942, breeding places consisting of reservoirs, borrow pits, swamps and pools in a group of five villages near the lake shore were cleared twice weekly by means of nets of ¾-inch mesh. No evidence of transmission was observed during the operations, and spleen rates and the size of enlarged spleens tended to decrease, while no such tendency was observed in untreated control areas. The cost is discussed. The removal of weeds by hand seems a practicable control measure where malaria is due to breeding in pools and reservoirs, but it is doubtful whether it can be applied to the Lake. If it were possible to admit sea water to raise salinity to over 1,000 parts per 100,000, this would stop breeding, but it would be too expensive to be practicable. Spray-killing of mosquitos in huts with pyrethrum insecticide [*cf.* **30** 168 : **31** 117, etc.] is recommended as a supplementary measure when an outbreak is in progress. Breeding in rice-fields was observed only when the crop was scanty and short-stemmed, and the planting of a variety of rice that grows densely and has long stems is recommended for fields that are close to the shore of a lake or creek.

THOMSON (R. C. M.). **Studies on the Behaviour of** *Anopheles minimus*. **Part VII. Further Studies on the Composition of the Water in Breeding Places and the Influence of organic Pollution.**—*J. Malar. Inst. India* **4** no. 4 pp. 595–610, 2 pls., 6 refs. Calcutta, 1942. **Part VIII. The naturalistic Control of** *A. minimus* **in shallow Earth Wells.**—*T.c.* pp. 611–614, 4 figs., 5 refs.

The first of these papers, which belong to a series [*cf.* *R.A.E.*, B **30** 170, etc.], deals with further studies made in Tocklai in Upper Assam on the influence of the organic pollution of water on oviposition by *Anopheles minimus*, Theo. [*cf.* **30** 103]. In the field observations described, the oxygen absorbed from alkaline permanganate was used in addition to albuminoid ammonia and the Tidy figure (oxygen absorbed from acid permanganate) as an estimate of organic matter. The degree of pollution [**30** 103] was calculated from the last two figures for comparison with previous results, and the first was used to determine the ratio of the figures for alkaline and acid permanganate, which is thought to give a better indication of the stage of decomposition. As in the earlier work, free and saline ammonia were of little use as the studies were concerned with natural waters such as reservoirs, wells and streams, and nitrites were almost invariably absent. On the basis of the results of collections of eggs and analysis of water in shallow earth or "kachcha" wells used by the coolies to supply drinking water and in pits dug at the edge of tea-garden drains in which breeding normally occurs [**30** 103], it is tentatively suggested that the organic content of water becomes a limiting factor in oviposition by *A. minimus* when the Tidy figure, alkaline permanganate figure, albuminoid ammonia and degree of pollution exceed 6, 12 and 1 parts per million and 8, respectively, and the ratio of figures for alkaline and acid permanganate is lower than 2. The organic content of the stagnant water in many rice fields and some reservoirs and borrow pits in which *A. minimus* was never found was well over these

limits at certain times of the year, but that of many others was well within the tolerated range, which indicates that water composition is not the only factor in the selection of a breeding place.

Tarapat (*Alpinia allughas*), unlike other shade trees, grows in streams as well as on their banks and forms pools of still water that appear highly suitable for *A. minimus*. Nevertheless, it is never found in them. The water was found to have a low or moderate figure for acid and alkaline permanganate titrations and for albuminoid ammonia and free and saline ammonia, but also a low ratio of figures for alkaline and acid permanganate, almost certainly indicating a difference in the quality of the organic matter, and an unusually low figure for dissolved oxygen, which was practically absent from some pools. This may be a limiting factor in this case [*cf.* **30** 103]. Another characteristic of the pools was the presence of flocculent masses of ferric material and iron bacteria, but it is thought probable that the bacteria are not repellent to *A. minimus* in themselves, but are favoured by conditions that repel it.

The second paper deals with the control of *A. minimus* in shallow earth wells in the Assam valley where pollution is not possible as the water is used for drinking. As the female will not oviposit in situations fully exposed to light, removal of marginal vegetation and the conversion of vertical walls into smooth, sloping ones effect almost perfect control [**31** 185].

Bhasker Rao (R.) & Ramoo (H.). **Observations on the relative Utility of *Gambusia affinis* and *Panchax parvus* in the Control of Mosquito Breeding in Wells and Tanks.** (Abstract.)—*J. Malar. Inst. India* **4** no. 4 pp. 633–634. Calcutta, 1942.

It is concluded from laboratory and field experiments that *Gambusia affinis*, which has been acclimatised in India for 12 years, has proved very useful for the control of mosquito breeding in wells and reservoirs in Pattukkottai, Madras. It is easier to rear in large numbers than the indigenous *Aplocheilus* (*Panchax*) *parvus*, and it consumes more larvae, thrives better in wells and is more effective in them and is more adaptable to diverse environmental conditions than the latter, which is not suited for use in confined waters [*cf.* *R.A.E.*, B **31** 116].

Parrot (L.), Donatien (A.) & Plantureux (E.). **Sur l'infection naturelle des phlébotomes par la leishmaniose générale de l'homme et du chien en Algérie.**—*Arch. Inst. Pasteur Algérie* **19** no. 2 pp. 209–218, 1 graph, 15 refs. Algiers, 1941. [Recd. 1943.]

Collections of *Phlebotomus* were made daily from 5th June to 23rd October 1940 in kennels near Algiers housing dogs suffering from general leishmaniasis [*cf.* *R.A.E.*, B **28** 17] in an advanced stage with eczema, ulcers, etc. The 1,142 females taken belonged to five species and included 1,090 of *P. perniciosus*, Newst., and *P. longicuspis*, Nitzu., which cannot be distinguished with certainty when alive [*cf.* **24** 312–313]. These two species had peaks of abundance in late June and early July and again in late September and early October [*cf.* **21** 218]. Of the engorged females dissected, 250 proved to be *P. perniciosus*, 248 *P. longicuspis*, 7 *P. sergenti*, Parr., and 3 *P. ariasi*, Tonn. No infection was found in the last two, but 50 of the females of *P. perniciosus* and 41 of those of *P. longicuspis* had the flagellate (herpetomonad) form of *Leishmania* in the digestive tract. Infection was found throughout the season, but the rate was highest (36·7 per cent.) in June. Infection developed in the same way in *P. longicuspis* as in *P. perniciosus* [*cf.* **21** 18], and was equally intense. It is concluded that both are vectors in North Africa. The flagellates were present in the proventriculus or positions anterior to it in females of one or other species

throughout the season. No infection was found in sandflies reared from 124 females, which probably included some infected ones, suggesting that hereditary transmission does not occur in nature.

Sautet (J.). **Etude d'un spirochète du groupe** *Sp. hispanicum* **de Buen, 1926, agent causal de la fièvre récurrente libano-syrienne.**—*Arch. Inst. Pasteur Algérie* **19** no. 2 pp. 240–247, 1 graph, 18 refs. Algiers, 1941. [Recd. 1943.]

An account is given of the morphology and pathogenic action on man and laboratory animals of a spirochaete that causes relapsing fever in man in Syria and Lebanon and is transmitted in nature by *Ornithodoros tholozani*, Lab. & Mégn. It belongs to the group of *Spirochaeta hispanica* and was transmitted by *O. tholozani* in all stages. The strain studied was obtained from ticks found in a cave near Damascus in July 1940, in which soldiers had previously acquired the infection. The disease in man was rather severe and lasted about five months. Guineapigs that had had relapsing fever following inoculation of blood from the human cases were found to be highly susceptible eight months later to the tick strain, which was very probably the same. It was later confirmed that immunity is very brief and gives place to a susceptibility possibly greater than the normal. It is suggested that *S. hispanica* may be of Asiatic origin and may have been taken to Spain and North Africa by the Arabs.

Collignon (E.). **Observations sur le comportement des anophèles en Algérie pendant l'année 1940.**—*Arch. Inst. Pasteur Algérie* **19** no. 2 pp. 265–272, 4 pls., 1 ref. Algiers, 1941. [Recd. 1943.]

Anophelines began to breed early in Algeria in 1940, owing to the mildness of the winter, but they did not become very abundant as the year as a whole was dry, so that breeding places were scarce and many persisted only for a short time or became polluted. *Anopheles maculipennis*, Mg., was found throughout the season and in all types of breeding places. Searches for adults of this species from January to October in an animal shelter in the Department of Algiers and for larvae in a neighbouring marsh showed that both were rare or absent in the spring, but became suddenly numerous in June. Larvae became scarce after the middle of July when the water was polluted by rotting stranded vegetation and were not found after the end of August. Adults were almost completely absent on 5th July as a result of the dry winds, which kill them or render them inactive. They were more numerous at the end of the month, but became scarce in August and September.

Collignon (E.). **La campagne antipaludique de 1940 dans le département d'Alger.**—*Arch. Inst. Pasteur Algérie* **19** no. 2 pp. 273–286, 4 pls., 2 graphs, 1 ref. Algiers, 1941. [Recd. 1943.]

The measures carried out against malaria and Anophelines in the Department of Algiers in 1940, which are discussed in this paper [*cf.* *R.A.E.*, B **30** 148], were followed by a greater improvement in conditions than occurred in neighbouring untreated areas as a result of favourable weather. Nevertheless, the measures designed to reduce Anopheline breeding are inadequate in many areas and the reservoir of infection is high. A recrudescence and extension of malaria would, therefore, probably occur if climatic conditions were suitable.

Martin (R.). **Le paludisme autochtone à Addis-Abeba.**—*Arch. Inst. Pasteur Algérie* **20** no. 1 pp. 10–14. Algiers, 1942.

The occurrence is recorded of four locally acquired cases of malaria at Addis Ababa, three caused by *Plasmodium vivax* and one by *P. falciparum* (*praecox*, auct.). None of the persons concerned had left the town for years, and all developed the disease in autumn, the season when *Anopheles gambiae*, Giles,

the only Anopheline in the district, is active [*R.A.E.*, B **28** 62]. The altitude of Addis Ababa is over 8,000 ft. It was formerly believed that malaria was not transmitted in Abyssinia at altitudes much over 6,500 ft. [**26** 67, 183], but Italian workers have recently reported the finding of cases that they considered to be locally acquired. The literature on this subject is discussed. It is difficult to estimate the extent to which transmission occurs, owing to the numerous introduced cases.

Adults of *A. gambiae* are present throughout the year in barn-yards and stables, but appear in houses only in spring and autumn. They are much more abundant and aggressive at the latter season. They are only slightly active in winter and even less so during the summer rains, when the temperature is low. Larvae are found from mid-September till early November; there may possibly be a secondary breeding season in spring if conditions are favourable, but it was not observed in 1938. Breeding does not occur in permanent collections of water, but always in warm, shallow pools left by the receding water at the end of the rains, and containing abundant plankton. The larval stage lasts about 15 days. Oviposition continues until the pool dries up, when large numbers of larvae die. Larvae taken from a pool that was practically dry on 27th October and placed in jars in the open continued to give rise to adults until 27th December. The absence of Anopheline larvae from the larger collections of water is attributed to the fact that these invariably contained *Xenopus clivii*, a Batrachian that consumes large numbers of the immature stages of mosquitos and other aquatic insects. In an experiment in 1939, one individual weighing only 5 gm. destroyed 100–115 mosquito larvae and pupae in 24 hours. As a result of these observations, the introduction of *X. clivii* into the pools where *A. gambiae* breeds is suggested.

Clastrier (J.). **Sur une épidémie de paludisme observée à Msila (Département de Constantine).**—*Arch. Inst. Pasteur Algérie* **20** no. 1 pp. 15–32, 8 pls., 2 maps. Algiers, 1942.

This account of a severe epidemic of malaria that affected nearly 90 per cent. of the population at Msila in the Department of Constantine, Algeria, in September and October 1941 and caused a high rate of mortality includes a report on a survey of possible Anopheline breeding places. The more important of those studied appeared to be a wadi running through the centre of the town and a network of irrigation canals. The irrigation system is described in detail. In winter, the main and secondary channels carry abundant water and the flow is rapid, but, as they are not cemented and have grassy edges, they would probably be excellent breeding places in summer when the quantity of water and rate of flow are small. A shallow stream or series of pools usually persists in the wadi during the summer. At the time of the investigation (17th–26th October), the bed had been flushed by rain, and Anopheline larvae (*Anopheles maculipennis*, Mg., and *A. hispaniola*, Theo.) were found only in a few high points. The stream appeared more suited to *A. hispaniola*, but only *A. maculipennis* was taken in houses and gardens. From June 1941 to the end of September, the flow had been very regular, as there was practically no rain, and the only rise in level above the town that would have been sufficient to flush away larvae was held behind a dam put into operation in 1940. Anopheline breeding therefore continued without interruption for four months, and a large population was built up. The outbreak of malaria is attributed to this.

Chabelard (R.). **La diagnose différentielle entre** *Anopheles hispaniola* **et** *Anopheles sergenti*.—*Arch. Inst. Pasteur Algérie* **20** no. 2 pp. 139–146, 4 figs. Algiers, 1942.

The colour of the palpi, which is the usual basis for separating adults of *Anopheles hispaniola*, Theo., and *A. sergenti*, Theo., cannot be used in the case

of the males, which are very difficult to distinguish. Descriptions are therefore given of the male genitalia and wing venation of both species based on an examination of specimens from southern Algeria, and points in these descriptions are compared with those of Christophers, Kirkpatrick, Theobald and Messerlin & Treillard. The pupal chaetotaxy is also described.

Collignon (E.). **La campagne antipaludique de 1941 dans le département d'Alger.**—*Arch. Inst. Pasteur Algérie* **20** no. 2 pp. 147–161, 2 pls., 2 graphs. Algiers, 1942.

Following the scanty rainfall of 1940 in the Department of Algiers, the late autumn rains were absorbed by the parched soil, and the winter rainfall being also below normal, the area of surface water in 1941 was smaller than it had been for ten years. The situation was hardly altered by the spring and autumn rains as they too were absorbed before they could produce pools or streams. Consequently Anopheline breeding was restricted, though the season was long and larvae of *Anopheles maculipennis*, Mg., were found all over the Department and throughout the campaign. A decrease in spleen indices and spleen sizes due to the comparative scarcity of the vector was accompanied by a further improvement among persons affected by the measures carried out against malaria and Anopheline larvae, which are discussed, but the reservoir of infection remains high, so that rainfall is still the principal epidemiological factor.

Poncet (A.). **Etude expérimentale comparée de l'action répulsive ou mortelle pour le pou de certaines substances.**—*Arch. Inst. Pasteur Algérie* **20** no. 3 pp. 213–217, 3 figs., 1 ref. Algiers, 1942.

When 30 lice, *Pediculus humanus*, L. (*vestimenti*, Nitzsch), were placed in folded cloth in a closed test tube containing a small piece of material impregnated with oil of eucalyptus, oil of lavender or methyl salicylate from which they were separated by a wad of cottonwool, all died in one day. When the material was impregnated with pyrethrum powder, nicotine at 40°C. [104°F.], oil of citronella and oil of rose geranium, the lice died in 2, 3, 4 and 6 days, respectively. Control lice died in 7 days. In a second series of experiments, the lice were placed in the open air on paper in the middle of a flat tray, 24 cm. long, that contained at one end a folded piece of flannel impregnated 6 hours previously with 40 drops of the substance to be tested and at the other a folded piece of untreated flannel. In all cases, about half of the lice immediately took refuge in the untreated cloth, and about half remained in the open. None was found on cloth impregnated with oil of lavender, geranium or citronella or methyl salicylate, but a few dead ones were found on cloth impregnated with oil of eucalyptus or nicotine. Very little difference in the repellent action of the various substances was noticeable when the lice were placed in the centre of a tray with folded material impregnated with different products at either end.

Parrot (L.). **Notes sur les phlébotomes. XXXIX.—A propos de deux** *Prophlebotomus* **d'Algérie :** *Phlebotomus minutus* **var.** *signatipennis* **et** *Phlebotomus fallax*.—*Arch. Inst. Pasteur Algérie* **20** no. 4 pp. 322–335, 8 figs., 31 refs. Algiers, 1942.

From a review of the literature, the author concludes that the subgenus *Prophlebotomus* of *Phlebotomus* is represented in Algeria by *P. minutus* var. *signatipennis*, Newst., *P. fallax*, Parr., *P. parroti*, Adl. & Thdr.,and *P. squamipleuris* var. *dreyfussi*, Parr., records of *P. africanus*, Newst., there being due to misidentification. He describes both sexes of *P. fallax* and *P. minutus* var.

signatipennis, accords specific status to the latter and gives its distribution in Algeria. It also occurs in the Anglo-Egyptian Sudan, corresponds exactly with the form wrongly identified as *P. minutus* var. *antennatus*, Newst., from the Belgian Congo [*R.A.E.*, B **18** 235; **19** 171] and so closely resembles *P. sanneri*, Gall. & Nitzu., from Gabon [**19** 171] and Abyssinia [**24** 160] that he regards the latter as a synonym of it. *P. fallax* is known in French North Africa only from the northern border of the Sahara (Algeria and Tunisia). Neither of these sandflies bites man, the hosts of both being geckos and other reptiles.

The author also considers that the true *P. minutus*, Rond., which was described from Italy, is the form subsequently described as *P. minutus* var. *meridionalis*, Pierantoni [**13** 152] and *P. parroti* var. *italicus*, Adl. & Thdr. [**19** 121], the typical *P. parroti*, Adl. & Thdr., being a variety of it. He proposes the name *P. theodori* for the Palestine species described as *P. minutus*, Rond., by Adler & Theodor [**14** 96]. He considers *P. minutus* var. *arpaklensis*, Perf., a synonym of *P. dentatus*, Sinton, and accords specific status to *P. minutus* vars. *antennatus*, Newst. [*cf.* **22** 27] and *occidentalis*, Thdr., since they can no longer be considered varieties of the true *P. minutus*.

Chabelard (R.) & Vérain (A.). **Action des ondes courtes sur le cycle biologique des moustiques.**—*Arch. Inst. Pasteur Algérie* **20** no. 4 pp. 352–356. Algiers, 1942.

An account is given of two series of experiments on the effect of short waves (5 metres) on the development of larvae of *Theobaldia longiareolata*, Macq. Daily irradiation for 5 or 10 minutes accelerated development, reducing the time required to complete the larval and pupal stages from 28 days to 24 and 23 in a field of medium strength that resulted in a rise of temperature of 1 and 2°C. [1·8 and 3·6°F.], and to 23 and 21 when the field was powerful and the rise of temperature 7 and 9°C. [12·6 and 16·2°F.]. The period of exposure to powerful radiation had to be reduced towards the end of the experiment. The larvae were killed by an exposure of 13 minutes, which caused a rise in temperature of 16°C. [28·8°F.]. When the heating effect of the waves was counteracted by allowing cold water to flow through a tube in the breeding receptacle, the waves had no effect on the duration of development. The larvae appeared to be unaffected by an exposure of 35 minutes. Daily heating of the water for 5, 10 or 15 minutes to 38°C. [100·4°F.], the maximum temperature reached during irradiation, did not accelerate development. Heating to 42°C. [107·6°F.] killed the larvae in 20 minutes. Daily irradiation, whether accompanied or unaccompanied by heating, did not modify the morphology of the larva or pupa or the male genitalia.

Annand (P. N.). **Entomological Problems imposed by War Conditions.**—*J. econ. Ent.* **36** no. 2 pp. 193–200. Menasha, Wis., 1943.

In this general discussion, the author points out that the protection of military personnel from the attack of disease-carrying and other noxious insects is of prime importance in time of war and that the protection of growing crops and their conservation in storage is both more important and more difficult than in peace time. He gives examples of a number of problems that have arisen in the United States.

Knutson (H.). **The Status of the Mosquitoes of the Great Swamp in Rhode Island during 1942.**—*J. econ. Ent.* **36** no. 2 pp. 311–319, 2 figs., 2 refs. Menasha, Wis., 1943.

The following is taken from the author's summary. The swamp, a typical fresh water one, near several military installations, consists of 14 general

larval habitats ; 18 species were found breeding in it and six others nearby, and four additional ones were collected in the area. Larval and adult weekly collections from February to December are represented graphically, and the breeding places and species taken are discussed. Larvae of several early spring species of *Aëdes* were very common, and two became severe pests. All had one generation and developed mainly along grassy edges when the water level was high. The level fell below the grassy protection in most habitats during late May and early June, and few larvae were then taken, except for those that bred in habitats where the water level was constant such as pitcher plants, root holes and seepage areas. Previously submerged vegetation afforded protection by late June, and *Anopheles walkeri*, Theo., and *Culex apicalis*, Adams, were predominant, the former along a river and the latter almost everywhere. These species continued to breed until almost the end of October, when they suddenly disappeared with the rise in water level.

Of the potential vectors of malaria, *Anopheles walkeri* was predominant in the swamp, *A. punctipennis*, Say, was more common along the border and in the uplands and *A. quadrimaculatus*, Say, was taken close by. Of the known experimental vectors of equine encephalomyelitis [*R.A.E.*, B **29** 39], *Aëdes triseriatus*, Say, and *A. vexans*, Mg., bred rarely in the swamp, but the latter had two very large broods in bordering pools following two series of heavy rains, *A. sollicitans*, Wlk., and *A. cantator*, Coq., came in from salt marshes nearby, and *A. atropalpus*, Coq., was collected in neighbouring rock pools.

The sphagnum pools that make up much of the dense flat swamp afforded little protection for larvae and harboured relatively few species of economic importance, but vast numbers of *Aëdes* were produced in early spring in shallow grassy pools in open areas bordering roads and streams and in cranberry bogs. Chemical treatment of the grassy edges in late March or April is considered a practical measure for reducing them, but not drainage or filling. Should the control of *Anopheles walkeri* become necessary, the grassy edges of the river should be treated chemically, or the grass removed and if necessary the banks straightened, or the water level lowered below the overhanging grass by the use of dams or otherwise. Dredging would be of doubtful value. Chemical treatment is considered preferable to drainage or filling for pools bordering the swamp.

Knowlton (G. F.). **Three new Pests invade Utah.**—*J. econ. Ent.* **36** no. 2 p. 353. Menasha, Wis., 1943.

One of the three insects here recorded for the first time from Utah is *Supella supellectilium*, Serv., which was abundant in the kitchen of a house at Logan in January 1942.

Parish (H. E.). **Sodium Fluosilicate to control Poultry Lice.**—*J. econ. Ent.* **36** no. 2 pp. 353–354. Menasha, Wis., 1943.

Between 28th January and 21st November 1942, tests involving 1,830 fowls, from two months old to adult, were made on the effectiveness of sodium fluosilicate as a substitute for sodium fluoride, now an essential defence material, in the control of poultry lice. The tests were made with sodium fluosilicate of 35 and 98 per cent. purity, and very encouraging results were obtained with dips at ½ and 1 oz. per U.S. gal. tepid water and with dusts in laboratory tests. The addition of an almost neutral soap at 1 oz. per U.S. gal. dip resulted in better and quicker wetting, but did not alter efficiency. Dips containing 1 oz. sodium fluoride or either sodium fluosilicate per U.S. gal. all gave complete kill of lice on several hundred birds, as did one containing ½ oz. of the purer sodium fluosilicate per U.S. gal. on 88 birds. In one field test of dusting, carried out on 166 birds that were moulting, results were less good than in the laboratory,

91 living lice being found 28 days later. Complete control of a heavy infestation of *Goniodes pavonis*, L., on seven adult peafowls and two that were one month old was obtained by dipping in a solution containing 1 oz. 35 per cent. pure sodium fluosilicate. No harmful effects on the birds were noted in any of the experiments.

EYLES (D. E.). **Accidental Transportation of Mosquitoes by Automobile.**—*J. econ. Ent.* **36** no. 2 p. 354. Menasha, Wis., 1943.

After a passenger car had been parked overnight at Reelfoot Lake, Tennessee, in late August, some 200 adults of *Anopheles quadrimaculatus*, Say, were observed in the luggage compartment, which had been left open. The car was then driven to Memphis, 120 miles away, the journey taking about five hours. Some of the mosquitos flew out of the compartment when it was opened at a stop on the way, and the others were still alive on arrival. The maximum temperature for the day was 89°F. at Memphis and 90° near Reelfoot.

TOWNSEND (C. H. T.). **Manual of Myiology. Part XII. General Consideration of the Oestromuscaria.**—Med. 8vo, 365 pp., frontis., 78 pls., 62 pp. refs. Itaquaquecetuba, São Paulo, C. Townsend & Filhos, 1942.

One chapter of this volume deals with the relation of the flies to man and includes discussions of the problems of *Glossina* spp., the housefly [*Musca domestica*, L.], the Australian sheep blowflies, *Dermatobia hominis*, Say, as a pest of cattle in Brazil, the screw-worm flies, *Cochliomyia hominivorax*, Coq., and *Chrysomyia* (*Compsomyia*) *bezziana*, Villen., the various Oestrids that infest domestic animals, *Stomoxys calcitrans*, L., and *Lyperosia* (*Haematobia*) *irritans*, L., with a list of the genera responsible for various types of myiasis in man.

PEMBERTON (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass. 1941–42* pp. 18–22. Honolulu, 1943.

Aircraft quarantine work was continued in Hawaii during 1941–42 in co-operation with the military and naval authorities, but was discontinued at Midway and Canton Islands in December 1941. The aircraft are sprayed before they are inspected, and most of the insects found were dead, but they included some serious pests, and one live mosquito of the genus *Anopheles* in an aeroplane from California. R. H. Van Zwaluwenburg found that the application of copper sulphate at $1\frac{1}{2}$ oz. per 50 cu. ft. water inhibited mosquito development for at least $2\frac{1}{2}$ months in water stored for fire protection, and, in co-operation with T. Nishimura, that Vatsol (a sulphonated ester of bicarboxylic acid) or 2-7-R (a sulphonated naphthalene) applied at the rate of 2 cc. of a 5 per cent. solution per 1,000 cu. ft. water did so for about 6 weeks and several months, respectively. He also found that *Baeus californicus*, Pierce, the egg parasite introduced from California for the control of *Latrodectus mactans*, F. [*R.A.E.*, B **28** 173, 223–224] was established on Maui in November 1941, over a year after it had been liberated there.

SMART (J.). **A Handbook for the Identification of Insects of Medical Importance.**—Cr. 4to, x+269 pp., 13 pls. (3 col.), 178 figs., refs. London, Brit. Mus. (Nat. Hist.), 1943. Price 15*s*.

This book is intended to help medical men, entomologists and others in the recognition of the Arthropods of importance in medicine or hygiene in the Old World, particularly when war conditions curtail facilities for having specimens identified at a central institute or for obtaining the necessary literature to identify them locally. The introductory chapter deals generally with the structure of insects, their development and life-history, classification and

nomenclature, and zoogeography, and is followed by one on the structure, life-history and classification of Diptera, including a key to the families and a simplified one restricted to those of blood-sucking Diptera. Morphological notes are then given on the families of Nematocera of medical importance, other than mosquitos, on Tabanids, with a key for separating the important genera, and on various families of Cyclorrhapha. Keys are given to and notes on the important genera of Muscids and Calliphorids and a key to the species of *Glossina*. Under the heading of Pupipara, Hippoboscids are very briefly described. A table of myiasis-producing larvae is followed by a key to these larvae and notes on their identification. The chapter on mosquitos occupies more than one-third of the volume. It includes instructions on the method of examining mosquitos and keys to the adults, pupae and larvae of the sub-families of CULICIDAE and tribes of CULICINAE, the adults and fourth-instar larvae of the genera of Old World CULICINI, and of the species of Palaearctic, Ethiopian, Oriental and Australian *Anopheles* (the last including *Bironella*), and a short key to the adults of the domestic species of *Anopheles* of Africa. The keys to the larvae include an indication of their breeding places. Lists are given of important Anopheline synonyms and misidentifications and of the chief malaria-carrying species classified geographically, and the distribution of the species in various regions is shown in tables. *Culex fatigans*, Wied., *Aëdes aegypti*, L., *A. albopictus*, Skuse, and *A. scutellaris*, Wlk., are briefly described.

The other Orders dealt with are Orthoptera, including a key to the four common domestic cockroaches, Anoplura, Hemiptera, Hymenoptera, Lepidoptera, the larvae of some species of which have urticating hairs or irritating secretions or act as intermediate hosts of the Cestode, *Hymenolepis diminuta*, Coleoptera, various species of which have been recorded as adults or larvae from the body of man, act as intermediate hosts of Helminths or have urticating properties, and Siphonaptera. The chapter on the fleas is by K. Jordan and includes a key to the important genera with notes on them, and one to eight species of *Xenopsylla*. R. J. Whittick contributes a chapter on Arachnida (scorpions, spiders, mites and ticks) including keys to the families and genera of ticks, with notes on the forms of medical importance. There are very short sections on Pentastomida and Myriapoda, also by Whittick, and on Crustacea. Leading references only are given, and these are placed at the end of the discussion of the subjects with which they deal. The collecting and preserving of insects is dealt with in an appendix.

HARTNACK (H.). **Unbidden House Guests. Vol. 1.**—Med. 8vo, i pp. 1–226, ii pp. 1–62, iii pp. 1–112, v pp. 1–142 [+18], ill. Tacoma, Wash., Hartnack Publ. Co., 1943. Price $12 plus postage.

This book, which deals in a popular manner with the plant and animal pests associated with houses, chiefly in the United States, includes much of the information contained in a previous one [*R.A.E.*, B **27** 156], but its scope is wider and the information considerably augmented; many of the copious illustrations also appeared in the earlier volume. It includes notes on such pests as mosquitos, fleas and ticks and on pathogenic protozoa, bacteria, rickettsiae, viruses and worms of which insects are intermediate hosts. It is in four parts, of which the last three deal systematically with plants, invertebrates (including ticks and mites, but excluding insects, to which a subsequent volume will be devoted) and vertebrates, and contains notes on the appearance, habits and control of individual species. The first part includes information, illustrated to a large extent by reference to insects, on the climatic conditions in houses, the factors influencing the spread and establishment of household pests throughout the world and the evidence whereby the presence of many of them

can be recognised. General methods of control are briefly outlined, and the desirability of preventing infestation by constructional methods is stressed.

[KUZYAKIN (A. P.).] **Кузякин (А. П.). On the Rôle of Mammals in the Epidemiology of Tick-borne Encephalitis of Ussuri District.** [*In Russian.*] —*Zool. Zh.* **21** fasc. 3 pp. 69–87, 105 refs. Moscow, 1942. (With a Summary in English.)

This is a discussion, based on the literature and investigations by the author and his colleagues in June–August 1940 in the primeval forest (taïga) in the Province of Ussuri (Russian Far East), on the importance of mammals as hosts of the virus of spring-summer encephalitis and the Ixodid ticks (*Ixodes persulcatus*, Schulze, *I. ricinus*, L., *Haemaphysalis concinna*, Koch, and *Dermacentor silvarum*, Olen.) that transmit it [*cf. R.A.E.*, B **31** 70]. There are 63 species of mammals in this region that are known or suspected hosts of these ticks; they are shown in tables, together with details as to which have been found infested and their frequency. It is considered that the immature stages can infest all the small mammals, as well as some of the larger ones, and they were found by A. I. Ivanov on many species of birds. The possible hosts of the adult ticks, however, are in general restricted to 25 species of mammals, mostly wild Carnivora and ungulates, but including dogs, pigs, cattle, sheep, goats and horses. The ticks cannot be controlled, therefore, by measures designed to reduce rodents, as has been suggested, since alternative hosts are too numerous. Most of the wild hosts of the adults, however, concentrate in well-defined areas of the forest, and the spread of the disease might be reduced by restricting them to these areas. When parts of the forest are brought under cultivation, as has occurred in European Russia, and are abandoned by the wild hosts, the infestation dies out, but it recurs as soon as domestic animals are introduced. This explains the association of the disease with cultivated forest areas in European Russia and with virgin forest in the Far East, where much less of the forest area has been reclaimed. In a final section, some of the wild mammalian hosts are divided into three groups according to whether the virus produces no symptoms in them and soon dies out, produces no symptoms but multiplies, or multiplies and causes disease. Of the tick vectors, *H. concinna* and *D. silvarum* belong to the first group and *I. persulcatus* and *I. ricinus* to the second.

KEAST (J. C.). **Dermatitis of Sheep due to the Mite** *Psorergates ovis.* **Results of preliminary Dipping Trials.**—*Agric. Gaz. N.S.W.* **54** pt. 4 pp. 177–179, 3 figs. Sydney, 1943.

A description is given of the appearance of merino sheep infested with *Psorergates ovis*, Womersley [*R.A.E.*, B **30** 140], which has recently been found over a wide area of New South Wales. Only a few sheep are attacked in some flocks and as many as 20 per cent. in others. The rate of spread varies greatly. When only small numbers of animals are infested and spread has been slow, control may be effected by isolating and disposing of infested sheep, but this was not satisfactory in severely affected flocks, and annual dipping in arsenical and carbolic preparations did not give control. A preliminary trial of a hot, home-made lime-sulphur dip on 30 sheep resulted in the disappearance of visible evidence of infestation, but it was not proved that the mites had been destroyed. However, all the 5,000 sheep on the property, 15 per cent. of which showed evidence of infestation, were dipped some 4–6 weeks after shearing in 1941 in a cold lime-sulphur solution, prepared by diluting a commercial concentrate so that the dip had an initial polysulphide content of 1·02 per cent. Dipping continued for nine days, during which time concentrate and water were periodically added in the same proportion, and the polysulphide content of the

dip dropped to 0·48 per cent. All sheep were kept in the dip for two minutes, their heads being pushed under two or three times, but it was difficult to wet lambs and the heads of sheep with this cold solution. All the sheep were examined before shearing in 1942, and only one showed signs of infestation. Its fleece was badly rubbed and it was immediately destroyed. It had probably been missed at the muster and not dipped. The use of ready-made concentrates is recommended, but for those who prefer to make their own, it is stated that a dip prepared by mixing 15 lb. freshly slaked lime and 25 lb. flowers of sulphur into a paste with water, boiling with 10–20 gals. water until it is golden brown and making it up to 100 gals. has been used with considerable success against *Psoroptes* [*ovis*, Hering] in South Africa. All sheep in a flock should be dipped, and great care must be taken to avoid entry of the fluid into the lungs, as this almost invariably causes death.

Papers noticed by Title only.

KNIPE (F. W.) & RUSSELL (P. F.). **A Demonstration Project in the Control of rural Irrigation Malaria by antilarval Measures** [against *Anopheles culicifacies*, Giles, in southern India].—*J. Malar. Inst. India* **4** no. 4 pp. 615–631, 2 pls., 1 map, 17 refs. Calcutta, 1942. [For briefer account see *R.A.E.*, B **31** 220.]

EADS (R. B.). **The Larva of *Culex abominator* Dyar & Knab** [from Texas, with notes on the status of the species].—*J. econ. Ent.* **36** no. 2 pp. 336–338, 5 figs. Menasha, Wis., 1943.

SENEVET (G.) & QUIÉVREUX (L.). **Les moustiques de la Martinique (2e mémoire)** [including one new species].—*Arch. Inst. Pasteur Algérie* **19** no. 2 pp. 248–264, 7 figs., 3 refs. Algiers, 1941. [Recd. 1943.] [*Cf. R.A.E.*, B **24** 312.]

MANINE (A.). **Un cas de myiase oculaire à *Oestrus ovis* Linné dans le Sahara central (Fort-Flatters, Sahara constantinois).**—*Arch. Inst. Pasteur Algérie* **19** no. 2 pp. 287–289, 6 refs. Algiers, 1941. [Recd. 1943.]

PÉDOYA (C.). **Un cas de myiase oculaire à *Oestrus ovis* à Beni Ounif (Sud oranais).**—*Arch. Inst. Pasteur Algérie* **19** no. 3 pp. 362–363, 2 refs. Algiers, 1941. [Recd. 1943.]

SENEVET (G.), CHABELARD (R.) & ABONNENC (E.). **Les moustiques de la Guyane.—III. Les Sabéthinés (2)** [including 2 new species].—*Arch. Inst. Pasteur Algérie* **20** no. 4 pp. 336–348, 7 figs., 1 ref. Algiers, 1942. [*Cf. R.A.E.*, B **28** 16.]

SENEVET (G.) & ABONNENC (E.). **Les moustiques de la Guyane.—IV. 2. Le genre *Aëdes* (s. g. *Finlaya*).**—*Arch. Inst. Pasteur Algérie* **20** no. 4 pp. 349–351, 1 fig., 1 ref. Algiers, 1942. [*Cf. R.A.E.*, B **28** 80.]

JELLISON (W. L.), KOHLS (G. M.) & MILLS (H. B.). **Siphonaptera. Species and Host List of Montana Fleas.**—*Misc. Publ. Mont. Bd Ent.* no. 2, 22 pp., 4 refs. Helena, Mont., 1943.

HUBBARD (C. A.). **The Fleas of California with Checklists of the Fleas of Oregon, Washington, British Columbia, Alaska, Idaho, Nevada, Arizona.**—*Pacif. Univ. Bull.* **39** no. 8, 12 pp. Forest Grove, Ore., 1943.

INDEX OF AUTHORS.

A reference in heavy type indicates that a paper by the author has been noticed.

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GENERAL INDEX.

In the case of scientific names, the page reference is cited only under the heading of the generic name.

When a generic name is printed in brackets, it signifies that the name is not the one adopted.

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* For relation to disease, see under Anaemia (Infectious), Dengue, Encephalitis, *Filaria* spp., *Icosiella*, Malaria, Tularaemia, Yellow Fever.

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ERRATA.

Page 31 5 lines from end for " *Echinophaga* " read " *Echidnophaga* "
" 87 line 13 for " *Xenopsyllus* " read " *Xenopsylla* "
" 89 line 13 for " *A. coustani*, Lay.," read " *A. coustani*, Lav.,"
" 104 line 16 for " attacking " read " attaching "
" 116 line 31 for " Winaad " read " Wynaad "
" 176 line 12 for " Boyton " read " Boynton "

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